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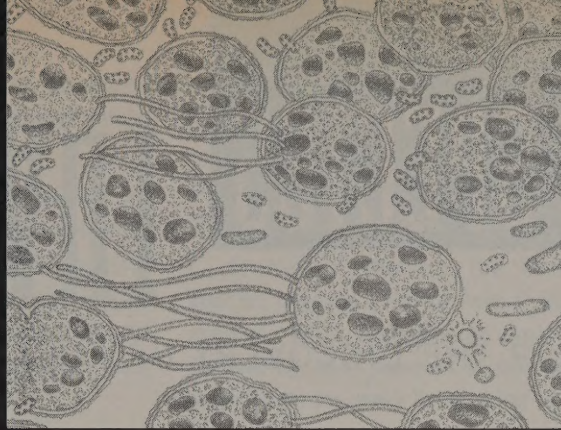
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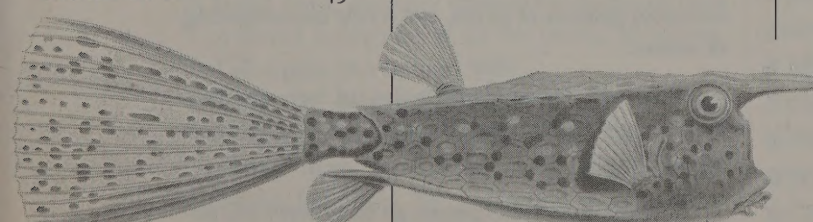
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ALL SPECIES

INVENTORY

A CALL FOR THE DISCOVERY OF ALL LIFE-FORMS ON EARTH

BY KEVIN KELLY

PERHAPS FEWER THAN 5% OF OUR PLANET'S SPECIES HAVE BEEN DESCRIBED. WHAT WILL IT TAKE TO KNOW OUR NON-HUMAN NEIGHBORS?

If we discovered life on another planet, the first thing we would do is conduct a systematic inventory of that planet's life. This is something we have never done on our home planet.

The aim of the All Species Inventory is simple: within the span of our own generation, record and genetically sample every living species of life on Earth.

This audacious goal will be accomplished by using one billion or more dollars of philanthropic wealth to fund and train a network of local collectors and naturalists throughout the world, and to employ the latest in information technology to manage this surge of bio-information.

What we will get from the All Species Inventory:

1) It will give us, for the first time, a complete list of "who is here," the roster of our fellow inhabitants.

2) It will provide a reliable baseline for counting populations and determining endangered species.

3) It will form the foundation for developing a complete genome of all life, and a new understanding of nature.

4) It will uncover multitudes of new species, many of which will have immediate cultural and economic impacts.

5) It will train many people as naturalists and scientists, who can leverage these skills further in their own lives and that of society.



6) It will distribute wealth from the developed world to far corners of the Earth by employing indigenous and native observers and collectors.

At the present time, scientific estimates of the number of living species on Earth, including microbes, range from 1.4 million to 200 million. This laughable range means we are simply clueless about the number, let alone types, of living creatures on Earth. Here is biologist E.O. Wilson on our deep ignorance of life on Earth:

In the realm of physical measurement, evolutionary biology is far behind the rest of the natural sciences. Certain numbers are crucial to our ordinary understanding of the universe. What is the mean diameter of the earth? It is 12,742 kilometers (7,913 miles). How many stars are there in the Milky Way, an ordinary spiral galaxy? Approximately 10^{11} , 100 billion. How many genes are there in a small virus? There are 10 (in ϕ X174 phage). What is the mass of an electron? It is 9.1×10^{-28} grams. And how many species of organisms are there on Earth? We don't know, not even to the nearest order of magnitude.

For several centuries naturalists have relentlessly explored Earth's wilds to catalog the incredible variety of species (both living and extinct). Each year their collective work takes us a few small steps closer toward the implicit goal of recording all species on Earth. In the last decade taxonomists have proposed a number of programs to accelerate this natural process, and to incrementally expand the scale of inventories around the world. The All Species Inventory builds upon these earlier proposals but with the additional—and crucial—explicit goal: to catalog ALL living creatures within the time span of one human generation (twenty-five years).

"All" is the crucial term. The difference between "many" and "all" is the difference between, say, a local public library and the universal library of all documents and texts. Knowledge crosses a threshold when it goes from "most" to "all." Geography crossed the threshold when it went from knowing a lot of the world to creating a globe with all continents in rough form; anatomy crossed the threshold once it produced a diagram of all the bones, all tissues, and all organs in a human body.

"Imagine doing chemistry knowing only one third of the periodic table," says biologist Terry Gosliner. Sure, it can be done, but with an immense handicap. We are trying to do biology knowing perhaps only a tenth, or one hundredth, of

our species. It is an immense handicap that does not need to exist.

Fixing the crucial figure of all species on Earth, and drawing up the list of all life, would enrich and enable the following fields of knowledge:

1) **Natural History:** The identification of a species triggers a whole field of inquiries into that species. What isn't named won't get attention. Cataloging each species is the best thing in the world to do for every living thing in the world.

2) **Conservation:** While the concept of focusing limited conservation resources on a few species-rich hot spots is probably wise, there is no definitive way to assess hot spots (are those spots really hot? are they really where we think they are?) unless we have an all species inventory first. Biocensus tallies can only follow inventory counts.

3) **Ecology:** The web of interactions between organisms and their environments, including other

Domain: PROKARYOTES

(no nucleus in cell)

Kingdom: BACTERIA AND ARCHEA

□ Already Described: 4,000

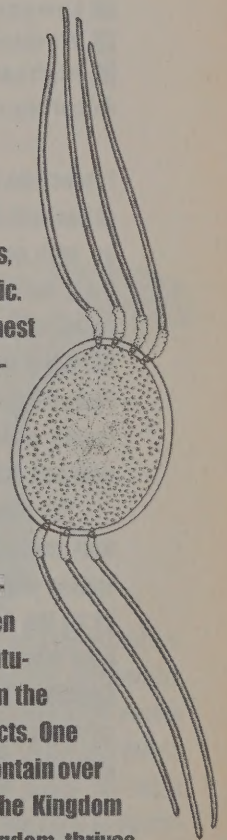
■ Lowest Guess: 50,000

■ Working Guess: 1,100,000

■ Highest Guess: 3,000,000

Accuracy of Guesses: Very poor

These two kingdoms include a slew of microbes, most of whom are unknown to the general public. They all have no nucleus and survive in the highest atmosphere, the hottest volcanic vents, and everywhere in between. Bacteria, to be "discovered," need to be cultured into masses and then seen under a microscope. Recently, the use of biochemical probes has demonstrated that there are a lot more prokaryotes than believed (prokaryotes that had been unculturable and therefore hidden to science). These "unculturables" have been discovered in soils, in deep sea sediments, as mutualists with protozoans and other organisms, and in the digestive tracts of many species, especially insects. One genus, *Spiroplasma*, lives in insect guts and may contain over a million species—the largest genus on Earth. The Kingdom Archea, only recently described as a separate kingdom, thrives in the oceans. Its numbers are purely speculative. Finally, since the prokaryotes can exchange genetic material without "reproduction" or "sex," the enumerating of "species" becomes problematic. —PW

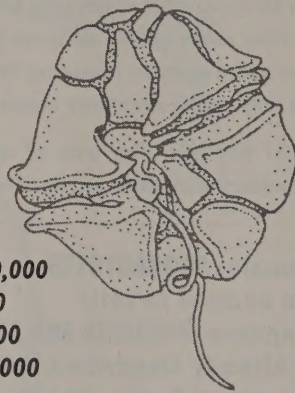


3 MILL.

BAR GRAPH REPRESENTS ESTIMATED NUMBERS, AND IS PROPORTIONAL TO GRAPHS IN ALL KINGDOMS. SEE KEY TO NUMBERS IN BOX FOR KINGDOM.

organisms, is woefully incomplete in every case if we cannot even list the other organisms in each environment. Ecologists are working with two cards out of the full pack.

4) **Evolutionary and Molecular Biology:** A full understanding of evolution at the genetic level will require the full outline of genetic innovation provided by all species. Many insights in molecular evolution will depend on a snapshot of the entire range of genomic life, much as progress in deciphering human genetics required the sequencing of the entire human genome.



Kingdom: PROTOCTISTA
 ("protozoa", "algae")

- Already described: 80,000
- Lowest guess: 250,000
- Working guess: 600,000
- Highest guess: 1,200,000

Accuracy of guesses: *Very poor*

Protoctists have evolved from the symbiosis of different kinds of bacteria into permanent associations. They all have a nucleus, with some of their total genetic material inside it. Some lack various genetic organelles such as mitochondria. Protoctists may be more than one kingdom. Colin Tudge (page 44) says there are twenty or more kingdoms hidden in the Protoctista gloss. They include green algae, protozoa, slime molds, water molds, giant kelp, slime nets, and many others with no common name.

The algal branch is very poorly known. It was just in 1980 that the minute prototists in the "picoplankton" of polar waters were discovered. Yet they could weigh in at 25 percent of all the biomass floating around these seas. Even landlubbing algologists have little knowledge of algal bark and rock species. But the wildcard is called "chromophyte" algae; guesses to their number of "species" range from 100,000 to 10 million. Among them, diatoms are a big unknown.

The "protozoan" branch has thousands of species still undescribed, mainly roaming around in between soil particles (heterotrophic heterokonts, if you can say that). Because of little fieldwork, and difficulties in calling clonal and asexual varieties of prototists "species," overall accuracy is very poor and the high guess may be the true number. —PW

1.2 MILL.

BAR GRAPH REPRESENTS ESTIMATED NUMBERS, AND IS PROPORTIONAL TO GRAPHS IN ALL KINGDOMS. SEE KEY TO NUMBERS IN BOX FOR KINGDOM.

5) **Biologic Wealth:** The commercial benefit of discovering millions of new species is staggering, based only (to begin with) on the pharmacological and biotech billions made from the few species we have already identified.

But why set a goal to accomplish this within one generation, and why now?

Because technology is making the inventory of all species both possible and urgent.

The following innovations make it thinkable to catalog all species:

- Foggers for arboreal insect species
- Remote viewers and trawlers for deep-sea species
- Cheap electron scanning microscopes for insect identification
- Transmission light microscopes and microvideo for prototists
- GPS for reliable location determination
- Hyperlinked keys for quicker identification
- Online databases for access to museum and herbarium collections
- DNA samplers for unculturable bacteria
- World Wide Web for globalocal bioinformatics

However, the most important technologies for this project haven't been invented yet. Furthermore there is a self-accelerating nature to technology in this realm: the faster/cheaper that technology fosters new species discovery and description, the more attractive it makes further innovations, compounding the discovery rate. Also, a global-scale effort to catalog all species self-amplifies discovery. Plant hunters, for instance, can uncover new insect, fungus, nematode, and mite species dependent on those plants, or vice versa, accelerating discovery. This means that the normal glacial pace and cost of species discovery could be shortened by many degrees fairly quickly. E.O. Wilson estimated that employing the traditional methods of long academic training, slow publishing, and no new technology, a full-scale inventory of life on earth could be accomplished in fifty years. New technologies for training, publishing, probing, and identification could certainly shorten the duration to twenty-five years, or one generation.

But this same technology, disguised as consumer technology, is accelerating the pressure on species habitat. The next fifty years will be a bottleneck where inflating human population and development will press against shrinking natural habitat. (After fifty years, declining world population and better technology will probably relieve this pressure.) The result of this near-term conflict will be the loss of species. Estimates of the loss range from 10 percent

to 25 percent of all species. Taking a liberal guess of the number of species actually on Earth and the most benign-case scenario of human impact in the next fifty years, the total loss still tallies up to millions.

In other words, sooner or later we'll accumulate the list of all species if we let science proceed incrementally. But even in a best-case scenario, if we wait another generation to compile an All Species Inventory, we'll come up with a final list that is several millions shorter than if we do it now.

But making a list does not save the entries. While an all species inventory is the foundation for protecting endangered species (and must be), it is important to distinguish these two endeavors. The All Species Inventory is not a census nor a complete geographical distribution map. It counts a species with a population of one the same as one with a population of one million. This is a roster, an elemental list of all life, an inventory of all the parts.

As simple as it is to state the goal of this project—to make life's list—there are many extremely difficult challenges to overcome. These include: the ever-slippery issue of deciding which varieties are species or subspecies or mere variants, and overcoming the sheer physical hurdles of surveying the Big Remaining Primeval Vastness: the Congo, the Amazon, the Deep Oceans, the Coral Reefs, Soil and Benthic Sediments, and Islands (oceanic and continental).

Most challenging of all will be dealing with the intellectual property issues such a large-scale effort will birth. How shall ownership, credit, and reward be divvied up among native residents, governments, collectors, backers, hosts, commercializers, and the global public? While the taxonomic and systematics community has evolved methods that work in many cases, it is not clear that these ways will scale up or withstand new technologies. The more successful this project is, the more visible the issues will be, and the more complex the solutions.

The wealth ultimately generated by this project will likely be staggering—new drugs and materials, better understanding, restoration, and management of ecological systems, higher quality of life due to attention to our natural capital, and (this is a hunch) *appropriate* genetic manipulation—from insights derived from a full genome of all life. (Eventually, though, in more than twenty-five years, every “species” will be genetically sequenced; the more species sequenced the fuller and better the picture.)

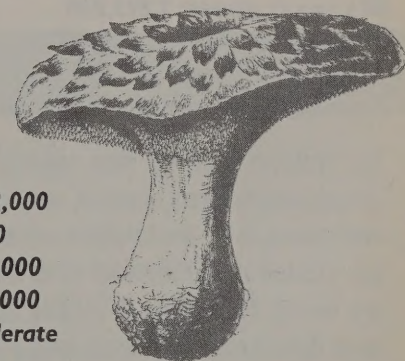
But because this project will take at least two decades to payoff, it is unappealing to crass commercial economics. For that reason, it is an ideal pro-

ject for the immense wealth being generated by digital technology in this generation. This wealth, created by imaginative individuals, is looking for imaginative ways to leverage the world. The All Species Inventory meets almost all the criteria of a lean, cascading good deed. It is truly global, fast (for natural history), deep, nature-based, technology-savvy, and entirely doable. And it feels good.

The All Species Inventory is a grand scheme. Self-made wealth is both intrigued and leery of grand schemes. The attraction of grand schemes is that they can be mythic. They connect with the spirit. They touch a lot of people. They can change viewpoints and thereby change the world. The All Species Inventory can do all that.

The caution about grand schemes is that their elaborate infrastructures can internally consume most of the available resources, so that the final result is decimated by the actual everyday operations trying to put the scheme into effect. In the end grand schemes are often not funded *because* they are grand, and incremental utility is funded instead.

The All Species Inventory is worth funding because it is both urgent and important, and because it can combine incremental utility and mythic depth. It can be big but lean. It will be result oriented (the more species the more successful) but



Kingdom: FUNGI

- **Already described: 72,000**
- **Lowest guess: 200,000**
- **Working guess: 1,500,000**
- **Highest guess: 2,700,000**

Accuracy of guesses: Moderate

The fungal kingdom is a lot more than mushrooms and toadstools. It includes yeasts, pin moulds, fungal strands in lichen, mycorrhiza (nets that associate with most vascular plants and help them obtain nutrition), rusts, smuts, mildews, and chytrids. The 1.5 million guess is scientifically conservative. No additions were made for fungi associated with insects. The guess was based on the ratio of vascular plants to fungi in merry ole England. The proportions may be different in the polar regions and the tropics. Another monkey wrench in the guessing process: it's difficult to apply the animal/plant species concept to most of the fungi so far described. —PW

2.7 MILL



BAR GRAPH REPRESENTS ESTIMATED NUMBERS, AND IS PROPORTIONAL TO GRAPHS IN ALL KINGDOMS. SEE KEY TO NUMBERS IN BOX FOR KINGDOM.

Kingdom: PLANTAE

☐ Already described: 270,000

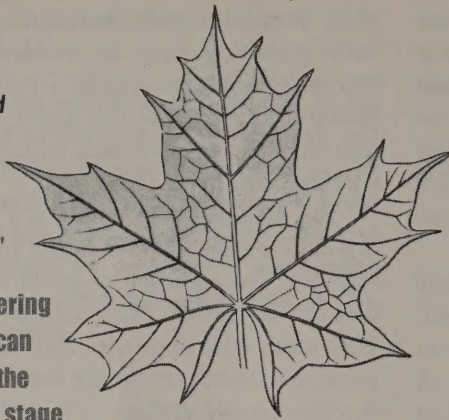
▒ Lowest guess: 300,000

■ Working guess: 320,000

■ Highest Guess: 500,000

Accuracy of guesses: Good

Liverworts, hornworts, mosses, clubmosses, resurrection plants, quillworts, horsetails, ferns, cycads, ginkos, conifers, and flowering plants are all plants. Plants can have large physical bodies in the haploid (half-chromosome) stage that develop from spores or, more like us, they can have large bodies in the diploid (two chromosome) stage from sexual embryos. "Species" concepts can get confusing in plants because, for instance, half the flowering plants known are hybrids with more than one set of chromosomes (polyploids). Many times, despite hybrid interbreeding, a plant population remains a "species" in the naming game of the taxonomist. But taxonomists feel they have a good grasp of the numbers of species, despite the polyploids and the long-term survival of various uni-parental "species." —PW



0.5 MILL

BAR GRAPH REPRESENTS ESTIMATED NUMBERS, AND IS PROPORTIONAL TO GRAPHS IN ALL KINGDOMS. SEE KEY TO NUMBERS IN BOX FOR KINGDOM.

Kingdom: ANIMALAE

☐ Already described: 1,320,000

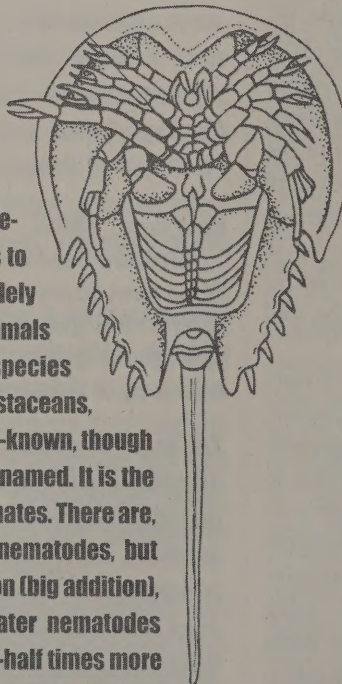
▒ Lowest guess: 2,825,000

■ Working guess: 9,800,000

■ Highest guess: 103,255,000

Accuracy of guesses: good to poor

The Kingdom Animalia, from sponges to elephants, velvet worms to octopi, mud dragons to tardigrades, is the best studied and most widely appreciated of the kingdoms. Birds and mammals are nearly completely described at the species level, though surprises occur each year. Crustaceans, arachnids, and mollusks are moderately well-known, though hundreds of thousands of species wait to be named. It is the nematodes, mites, and insects that defy estimates. There are, for instance, 25,000 described species of nematodes, but 400,000 is the current "best guess." In addition (big addition), others feel that parasitic, fresh, and saltwater nematodes may exceed one million species—two-and-a-half times more than the best guess. Similarly, 950,000 insects have been described. 8 million is the best guess, but some insect enthusiasts have bet on 100 million as the actual number on Earth. —PW



grand (ALL species).

This project can be accomplished in a very decentralized manner. It may be a paragon of globally decentralized work of any type. The inventory actually benefits from the redundancy natural in such decentralized efforts. Most of the collecting, preliminary sorting work, and an increasing volume of taxonomic naming, will take place in small corners of the world, thus spreading the work to a diverse group of nationalities and biomes. Most of middle management can be accomplished by Linux servers. Most of the money poured into the project will make its way to collectors and naturalists far from the source of that money, and often in places where precious little other money flows in. Lastly, the many students, or indigenous naturalists, or lonely local experts put to work by this project would come away with both traditional taxonomic skills (now rapidly disappearing from science) and other marketable new skills of managing global databases and information flows.

Here is a challenge to anyone hoping to leave his or her mark in a big way. Can you imagine a project other than All Species Inventory with a larger global impact (more countries touched), that would consume less internal resources, require less staff, generate more scientific knowledge and more commercial products, serve the beleaguered environment more, further increase appreciation of Earth as much, and do a better job of satisfying our longing to do something bigger than ourselves?

Write us if you do.

Kevin Kelly, editor and publisher of *Whole Earth* from 1984 to 1990, continues his amazingly Big Picture pursuits. In this neo-biological civilization, he has integrated his digital past (the WELL, the Hackers Conference, Cyberthon, and *WIRED*) with urgent concerns for environmental crises. His books include: *Out of Control: The New Biology of Machines, Social Systems and the Economic World*; and *New Rules for the New Economy*.

103 MILL

BAR GRAPH REPRESENTS ESTIMATED NUMBERS, AND IS PROPORTIONAL TO GRAPHS IN ALL KINGDOMS. SEE KEY TO NUMBERS IN BOX FOR KINGDOM.

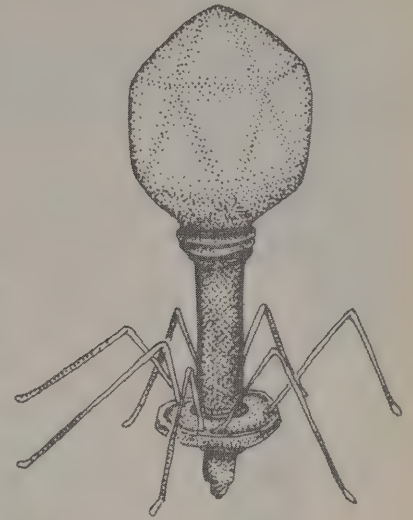


Kingdom: VIRUSES

- Already described: 5,000
- Lowest guess: 50,000
- Working guess: 500,000
- Highest Guess: 1,000,000

Accuracy of guesses: Very Poor

There are those who insist viruses are not living and should not be part of an all species census. There is surely no agreement on what a virus "species" might be, since, by animal/plant criteria, they have no sex, can't interbreed, and are all parasites. But a "rough equivalent" by shape and operational abilities and associates should permit inventorying the distinct kinds of viruses. The difference between described and guessed is outrageous. The unknowns include: viruses on non-crop plants; viruses on insects; viruses in marine plankton; viruses in plasmids of fungi; and viruses on phages of bacteria. Since so few insects and bacteria have been described, it's easy to see why virus numbers could approach the highest guess. —PW



1 MILL.

BAR GRAPH REPRESENTS ESTIMATED NUMBERS, AND IS PROPORTIONAL TO GRAPHS IN ALL KINGDOMS. SEE KEY TO NUMBERS IN BOX FOR KINGDOM.

ALL SPECIES FOUNDATION

A nonprofit foundation called All Species has been established to receive initial funds for the project and to serve as a core for its organization. The full scope of the project is expected to emerge as needs and practicalities come into clearer focus. What needs to be done first? (A sequence of conferences is under way to determine scientific and organizational priorities.) What would have highest yield at lowest cost? (Using the Web to fully connect and rationalize the existing disparate rosters of species seems a necessary, not very expensive step.) What is the time and money needed to get to near-closure on "all" species? (twenty-five years and one to three billion dollars are first approximations.) What are the realities of getting serious field science established and maintained in devel-

oping countries, where most of the undiscovered species are? (There are by now enough failures and successes in this domain to determine best practices and proceed accordingly.)

To succeed, All Species will need to have a mix of capable and committed Scientists, Framers, and Funders. Outstanding scientists such as those in this issue of *Whole Earth* have already stepped up. The search for great framers—those who can run the operation—is on. Equally crucial is finding great funders—individuals and foundations who can handle the scale of money needed for ramp-up and follow-through.

Taxonomists worldwide since Linnaeus have dreamed repeatedly of identifying all the species on Earth. Conferences were held and organizations named, but all so far have been

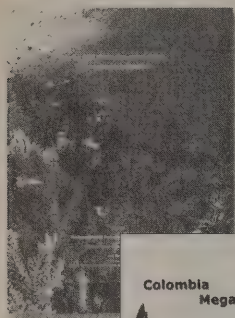
stillborn for lack of realistic funds. The hope for this All Species project is that the private wealth generated by the New Economy—along with new tools such as the Internet, GPS for geo-location, and DNA analysis—may make the Linnaean task finally completable. And not a decade too soon, given the rate of species loss thanks to humanity operating in ignorance of what's really out there.

The first half-year of research was to determine if it is doable. The preliminary answer is yes, it is doable. And extremely worth doing.

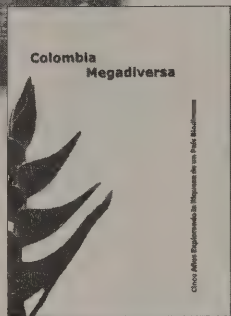
—Stewart Brand

All Species, 727A Liggett Avenue,
San Francisco, CA 94129.
info@all-species.org, www.all-species.org.

WHAT'S OUT THERE ALREADY?



Biodiversity strategy documents for New Guinea and Colombia.



Most nations of the world do not have complete inventories of their flora and fauna, let alone their fungi, protists, and prokaryotes (microorganisms). Hawai'i, Papua New Guinea, Colombia, Illinois, and Bermuda have intensive biological surveys (though the poor fungi and microbes are once again passed over). Zoological surveys are active in India and Pakistan; floral surveys are ongoing in Guyana and Brazil; and national inventories in England, Spain, Italy, the Netherlands, and other European nations are underway. We're sure there are others, but all are narrowly focused. Their goal is not all species.

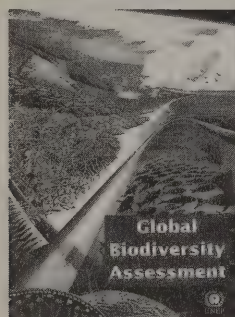
The most complete surveys we know of are in Costa Rica (page 32) and the Smoky Mountains. The Great Smoky Mountains National Park All Taxa Biodiversity Inventory (ATBI) is the most accomplished American attempt to survey all taxa. The Smokies contain one of the richest temperate forests known; the national park may harbor more than

100,000 species, of which a maximum of 10,000 have been described. The ATBI hopes to find the other 90,000 in fifteen years, at a cost of about \$1,000 to \$2,000 per species (\$100 million total, or \$250 million including microbes). The project, a partnership of the nonprofit Discover Life and the National Park Service, will coordinate with academic institutions and citizen groups and inventory roughly 500,000 acres. Right now, about eighty field biologists are checking plots to test various inventory approaches. Already new species have turned up, including a giant earthworm. Most of the surveyors are not paid, yet the project is overwhelmed by volunteers—a warning about the human organization dimension of inventories. The project is short of the money required to meet its deadlines. Besides a building funded by Congress, it has received only a few hundred thousand dollars. Along with a checklist, the project is designed to make distribution maps, to improve protection, and to compile a "bestiary" of all information by species. —PW

THE GREAT SMOKY MOUNTAINS NATIONAL PARK ALL TAXA BIODIVERSITY INVENTORY (ATBI)

Great Smoky Mountains National Park,
107 Park Headquarters Road,
Gatlinburg, TN 37738, www.discoverlife.org.

THE BEST ACCESS TO GLOBALLOCAL SPECIES INVENTORIES



GLOBAL BIODIVERSITY ASSESSMENT

V. E. Heywood, executive editor. 1996. 1140 pp. \$54.95. Cambridge University Press.

Though five years old in a fast-changing world, this colossus, published for the United Nations Environment Programme, is the one-volume

whole earth encyclopedia of biodiversity. In short, the best intro and reference for the deeply involved. Most of our factoids were gleaned here. It is particularly good on the advent of molecular biology. —PW

“ Table of Contents

3. Magnitude and distribution of biodiversity
4. Generation, maintenance and loss of biodiversity
5. Biodiversity and ecosystem functioning: basic principles

6. Biodiversity and ecosystem functioning: ecosystem analysis
7. Inventorying and monitoring of biodiversity
8. The resource base of biodiversity assessments
9. Data and information management and communication
10. Biotechnology
11. Human influences on biodiversity
12. Economic values of biodiversity
13. Measures of conservation of biodiversity and sustainable use of its components

“ A high amount of genetic variability is found in most species....For molluscs, amphibians, reptiles, and mammals, about 25–30% of the variation is due to genetic differences between populations, whereas for birds and insects which have higher gene flow, this figure is only 8–10%.

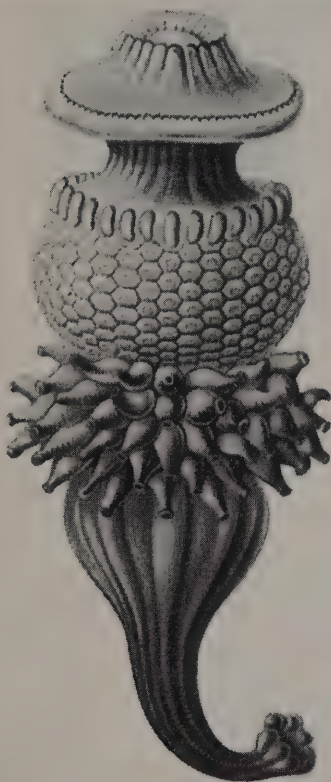
BIODIVERSITY II Understanding and Protecting Our Biological Resources

Marjorie L. Reaka-Kudla, Don E. Wilson, and E.O. Wilson, eds. 1997; 551 pp. \$29.95 (\$34.45 postpaid). Joseph Henry Press. Distributed by National Academy Press, 2101 Constitution Avenue, NW, Lockbox 285, Washington, DC 20055. 888/624-8373, 202/334-3313, books.nap.edu (20 percent off for online orders).

The best academic survey of all taxa biotic inventories and how they might best be done, the issues with hotspots, the influence of DNA on species descriptions and classification, the infrastructure problem, extinctions, and new directions such as gap analysis. Short well-written essays by many of the most thoughtful biologists around. By the way, there is no easy fun intro to this vision. That's why we're doing this issue. —PW

Knowing Neighbors

INTRODUCTION TO THE ALL SPECIES INVENTORY ISSUE



In Kenya, the vervet monkeys that roamed my camp chirped and barked pragmatic and emotional species names: one vocalization for *danger above* (an eagle), which might also mean “head for the bushes;” another for *danger about* (leopard or cheetah), which might also mean “head for a tree”; and one for *ground danger below* (boa constrictor), which might also mean “flee or mob, but pay careful attention.” The vocalizations varied from group to group, but in each group the three “species” were “codified” in sound. Humans, apparently just like vervets, can’t resist observing, memorizing, and uttering distinctions. It’s a long primate tradition.

When Kevin Kelly mentioned his idea to launch a project to observe and name all the planet’s species, I smiled. Great! Throw that Big Idea at the world. Push our natural tendencies to the limit. Know thy neighbors, all of them; all of them on the planet. What a whimsical, quixotic, and daydreamy ideal! The proposal reminded me of the first photos of the Earth from outer space, which served as Whole Earth’s long-term icon. The NASA photo of our suspended blue planet didn’t have an agenda. It just made you think and wonder. Contemplating “Lifeboat Earth” from the opposite end of the spectrum—invisible microbes, jellyfish, blue whales, and redwoods—demands millions of images, rather than one. Beguiled, *Whole Earth* is devoting over fifty pages to deliberating the first broad-based attempt (not located exclusively within the academic/scientific community) to ferret out and describe life on Earth, without arrogance or possessiveness or sacrilege.

Disclaimer: This issue does not necessarily reflect the opinions of the All Species Foundation

(page 9)—though hats off to its board members (Stewart Brand, Kevin Kelly, Terry Erwin, and Ryan Phelan) as our most important immediate influences. The dialog that they started with a couple dozen scientists and friends was of huge help (page 105).

THE DREAM: A “BESTIARY” OF WORLD SPECIES

The dream is to create a contemporary, dynamic bestiary, with updateable descriptions and images of all the planet’s life-forms: micro and quasi-micro, fungi, animals, and plants. The first step is to seriously work on Earth’s Life List. Some taxonomists guess how many species belong to a family or kingdom by “feel” from their own experience with journals and fieldwork, bargaining with colleagues about what is “reasonable,” given habitats and the quality of taxonomic classification. Known as the “Delphi” method, after the oracle, competing bioprophet predictions range from 15 million to 100 million total species. Other bio-diviners make ratios from geographic areas they know and extend them to the planet. For instance, working estimates of fungi come from comparing the number of plants to the number of fungi known in well-studied England (about 6 to 1), then extrapolating to the whole planet (polar regions and ocean included). Still other life listers like graphs. They chart how many species have been collected over the years. If it’s fewer and fewer each year, they assume that there are fewer and fewer to be found.

THREE MINI-SECTIONS

In this issue, we explore the all species Life List in three steps. Step One, “Discover,” occurs outdoors. Wild explorers, indigenous guides, curious taxonomists, and new teams of parataxonomists (page 28) scout, spot, sample, and collect the elusive beasts. Our rallying cry: Bring back natural history; the joys and stories of discovery (pages 13 to 37)! Step Two, “Describe,” occurs indoors, in the lab, museum, or herbarium, where techies and specialists look for details that distinguish one life-form from another and portray them with text and images. The indoor rallying cry: Rejuvenate the art of describing life-forms (pages 38 to 49); make the profession once again honorable and envied.



Finally, in Step Three, “Preserve and Cross-Reference,” the now-described life-forms become vouchers in collections, and are cataloged (online, on CD-ROMs, or on paper) so that others can find out what has been done (pages 50–57). Each easily referenced species can

attract active fans to protect it and spread news about it to the world at large. The rallying cry: Meld the best of planetary ecology with the best of digital technology (page 50).

Inspired by the all species inventory, we foretell new forms of globallocalism—decentralized academic science, with more local citizen scientists (page 28); natural history re-embedded in the institutions and cultures of former colonies, and—actually and virtually—the return of silently stolen knowledge back to its ecoregion (page 50).

PERSONAL CHOICES

As I wander through conservation battles, I find myself and friends stretched between three stances: the warrior protecting the planet, the poet-priest celebrating Earth as a never-ending blessing, and the scientist pursuing Earth knowledge. All three possess powers that can change the world. Sometimes while presenting scientific data about endangered squirrels or unclassified ground beetles, I know in my heart that no amount of information will change the minds of the habitat destroyers. I yearn to chain myself to a tree, preferring the role of naturalist gladiator to rational arbitrator of knowledge. Sometimes I envision (or accomplish) leaping from my chair, running to the boonies without binoculars or field guides (without even my glasses), to honor the myriad life-forms and recite poetry to the winds, finding solace in the priestly naturalist-poets like Gerard Manley Hopkins: “Glory be to God for dappled things/For skies of couple-color as a brindled cow/For rose-moles all a stipple upon trout that swim...”

What do these emotional tensions have to do with our issue? Pursuing the all species inventory will revise the roles of poet-priests, protectors, and taxonomists as well as the paradigms of food webs, climate change, and conservation. In Noah’s time, the ark held a few hundred species. By the 1500s,

the ark swelled as the Life List surpassed a few thousand species. By 1900, known species had grown to a million. In 2000, millions of known or suspected life-forms humble poets, priests, scientists, and warriors. Noah, with quite a bit of wine, was not humbled. He could hold together these multitudes with his formidable talents. Now Noah’s ark is Lifeboat Earth—the biosphere itself—a phenomenon both overwhelming and dramatic. For instance, we don’t have a clue, from the planet’s point of view, as to which species are the “most valuable” to slow global warming, to maintain the atmosphere, to serve as the umbrella species sheltering an ecosystem, or to act as the crucial networkers in a food web. The all species inventory attempts to empower humans to work more in harmony with the biosphere by treating all life-forms equally. Not since Noah have we entertained the possibility of such an expansive open mind, thorough natural history and compassion.

THE “YES, BUT” ATTITUDE

By this point, I can hear the “yes, but” that always confront wild ideas. Yes, but money would be better spent preserving habitat or finding medicines to enhance human life. Yes, but there should be places where the names of life-forms are not known, where mystery thrives. The all species inventory is not a project *instead of* conservation of habitats (page 25), *instead of* commercial pursuit of medicinal and crop-improvement plants (page 48), *instead of* re-visioning taxonomy and the meaning of species (page 43), or *instead of* respect for the sacred nature of naming and honoring individual, vivid nonhuman lives (see Wendell Berry, page 61). This is a “yes, those projects *and* the all species inventory.”

In the 1970s, near and within what was my hometown in California, bird lovers began to listen to White-crowned sparrows. As our hearing became more subtle, we heard five distinct song dialects around the Bay Area. Our sensitivities and interest were the next step after inventory. We began what I call “the perfection of being local”—knowing intimately whom you live among. Biologists call this learning “fine grain,” as opposed to “coarse grain.” Listening and naming, entering the local mysteries and enjoying individuals like the singer of the music coming from my backyard coyote bush. Very hometown. But before settling in, there is the understanding that we share a planet and that knowing all our neighbors is a mighty fine way to live. —PW

Discovery, or

"FIND THE SUCKERS"



Those in quest of new species tend to be a bit maniacal. Myself included. I was once part of a group of birders who kept discovering birds in wrong places and had a hard time convincing others that we were not on drugs. We even united for a few months into the Society of Maniacal Naturalists. And, as many of the stories that follow amply illustrate, the quest to perceive species (the Latin root of "species" means "to observe, sight, espy, watch, look") is an occupation of perseverance, irreverence, and exceptional abilities at scouting, dragnetting, beating the bushes, leaving no stone unturned, memorizing untold songs and wing whirrs, and, more recently, probing with DNA wands, dredging the deepest seas, videotaping jaguars and giant squids, and fogging the rainforest with organic insecticides in order to receive a blessing of beetles. Some naturalists like E.O. Wilson would claim that this personality is largely a gift of birth, though many, deprived of the opportunity as youths, later discover its joys. I always wonder how I went from the streets of Brooklyn to the temperate fjord forests of Chile in quest of a rumored shrew.

One lovely aspect of discovery is that the required human talents defy rankings, formal education, and professions. This next section will tell a few discoverer tales: of tour guide Ted Parker, a man who held 4,000 bird songs in his head; of novelist Vladimir Nabokov's contribution to butterfly naturalist history; of parataxonomists changing from their lives as farmers to become sharp-eyed field collectors; of painter Audubon's tricks on the true maniac, Rafinesque. Add to these every sort of "amateur" and "professional" naturalist, as well as the academic specialist (Miriam Rothschild and her love of fleas; E.O. Wilson on ants) and you cook up quite a wonderful dialog, tinged with competition, possessiveness, ego and cross-checking, but fundamentally honoring the pursuit of mysteries in life.

Let's not romanticize. The quest for species began in earnest with conquest. To be powerful was to have more knowledge than anyone else of the living world. Specimens were sent dead and alive back to

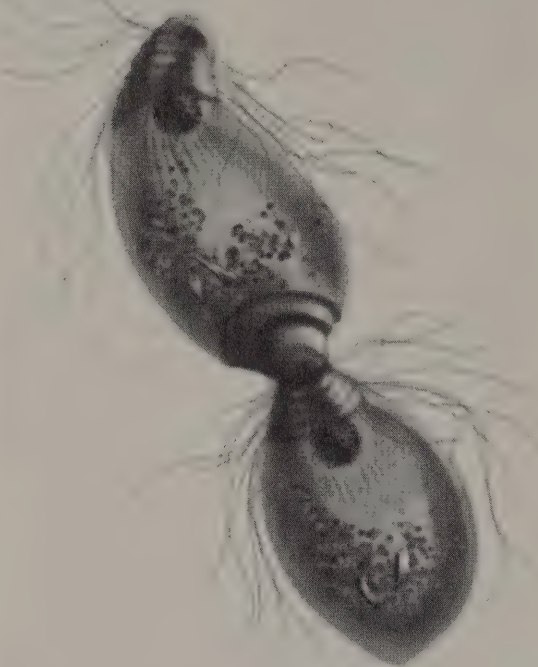
the "mother" country. Many naturalists earned their livelihoods finding profitable "exotics"—plants and pets that Europeans had never seen. Today, most of the 2.5 billion specimens in collections worldwide are in North America and Europe. When we consider an all species inventory, this history comes back to haunt us. Nations that will be most open to surveys will be nations that can forgive the conquerors. Naturalists and other scientists who will be most successful will be those who admit the stark past and help rectify the wrongs. They can, for instance, find funding to digitize all the specimens of former colonial nations so that the nations-of-origin have access to this knowledge. They can assure that duplicates are placed in national herbaria or museums, and help find funding for nations to build their own natural history infrastructures. If done right, the twenty-first century collector will also be a diplomat and a source of healing. This doesn't stop the fun. It just adds humanity to the mania.

And the twenty-first century will have new and more focused naturalists. There have been too few explorers for the kingdoms and orders that remain the most undescribed. We need a fervor for nematodes and mites; micro-algae and fungi (especially the fungi associated with insects); terrestrial arthropods; bacteria that have not been and can't be cultured. If there is but one species of parasitic nematode, protozoan, bacterium, or virus for each multicelled creature on Earth, then the species list will skyrocket beyond the current estimate of 30 million. If the guts of creatures from bioluminescent squid to termites, from cows to us, truly each have a necessary and intimate symbiont—bacteria to help us digest, fungi to help plants ingest minerals, prototists to transform wood into termite food—then the species count could zoom toward 100 million. So we start with Lynn Margulis and the need to inventory the microcosmos.

As we finished this issue, I had lunch with Sarah Weigel, who was helping the All Species Foundation. Her job was characterizing DNA in a lab, but she yearned to study treehoppers outdoors. I thought: If this issue can find one lover of treehoppers a place in the world to pursue that passion, it will have done enough. —PW

INVENTORY THE MICROCOSMOS !

Bringing love and order to the taxonomy of lower organisms



DRAWING BY KATHRYN H. DELISLE.

BY RICARDO GUERRERO, LYNN MARGULIS, AND MICHAEL DOLAN, and from notes from Lynn Margulis's Symbiosis class in the Organismic and Evolutionary Biology graduate program at the University of Massachusetts, Amherst

Although no one knows, nor ever has known, the extent of biodiversity at any one given time, formal scientific attempts to catalog the known living world have been made since Carolus Linnaeus (1707–1778). The vast majority of scientists have described mammals, birds, reptiles, fish, and flowering plants. In general, people love these creatures (especially when they resemble children). We are repulsed by spiders, mildew, and bacterial slime. We may even have an innate tendency to respond positively to those organisms (the “biophilia hypothesis”) with which we share a strong and positive past history—pandas, Coho salmon, grapevines, and woodland shrubs. But to complete the Linnean task, or even to approach its completion, a detailed systematics of the less charismatic species, especially the microbial world, needs to be

undertaken, especially before habitat destruction and extinction render this impossible.

AN EMBARRASSMENT OF MICROBIAL RICHES

The real news of twentieth-century science is that the greatest diversity of life on Earth is not in any plant or animal group. Rather it lies squarely in the province of those organisms that are always wrongly forced into the plant or animal kingdoms, or whose very existence is simply ignored. These are the inhabitants of the planet's microcosm, organisms that require a microscope for their proper visualization. Bacteria (unless they swim) and fungi, for instance, traditionally have been squeezed into the inferior portions of the Kingdom Plantae, whereas protocists (algae, slime molds, foraminifera, ciliates, water molds: some thirty major groups) have been split in many irrational and pragmatic fashions into either Animalia and Plantae.

The first Linnean rule of taxonomy—that all organisms of the world are either plants or animals and should be cataloged into one of these two groups—ironically became a major impediment to the fulfillment of his dreams. This pigeonholing has greatly thwarted attempts at completing an inventory of all the planet's species.

Many brilliant biologists tried to overcome this taxonomic impediment, but were ignored, dismissed, or worse, ridiculed. The German Ernst Haeckel (1834–1919) tried to establish a third kingdom for many microorganisms, but was ignored. John Hogg (1860) tried to separate out all creatures with a nucleus that were not obviously plants or animals. He was ignored until 1956 when Herbert Copeland (an American at Sacramento City College) resurrected Hogg's work as the Kingdom Protocista. But it wasn't until Robert Whittaker (1924–1980) persuasively argued for five kingdoms (separating out fungi, protocists, and non-nucleated bacteria) that the Linnean mind-set began to crumble. Today, some believe that as many as twen-

Left: Protocist sex; *Trichonympha*, a termite symbiont, mating. The female is “on top.”

ty kingdoms will be declared once the protoctists are figured out!

In the biological community, a great tolerance for contradiction and inconsistency within microcosmic taxonomy persists, because of the separation of practices by at least three classes of practitioners and the microcosmic challenge to the species concept. Zoologists use the *International Code of Zoological Nomenclature*; botanists follow the distinct rules of the *International Code of Botanical Nomenclature*; and bacteriologists, having seceded from the botanists, follow the rules of the *International Code of Nomenclature of Bacteria*. Meanwhile, the mycologists, who study the fungi kingdom, have begun their own international mycological congresses; they tend to use rules of botanical nomenclature, but confine discussion of the taxonomy of the organisms to their own journals and societies. Virtually no taxonomic communication exists between members of these communities.

A second Linnean rule was that each distinct kind of life form have a unique name: a genus name and a species name. The same genus name is allowed for both an animal and a plant (e.g., *Proteus* the fish and *Proteus* the South African flower), because of the separation of the kingdoms. Having the same name presents no difficulties whatsoever to the zoologist nor to the botanist. But names become a serious source of confusion for the student and investigator of "lower organisms," when an organism is forced into the animal or plant kingdom, or tossed between the eubacteria, fungi, and protoctist kingdoms. (There is even a bacterium, *Proteus vulgaris*!)

Without the commitment, scientific dialogue, and funding for study of the microorganisms that existed for animal and plant study, the taxonomic study of microbes slowed almost to a halt. Algologists, protozoologists, and protistologists (whose titles still reflect the old taxonomy, but who actually study protoctists), have become disenfranchised by the continued dominance of the plant/animal mind-set. Students did not see mysteries of microcosmic taxonomies as opportunities and did not become lower-organism taxonomists. The Cambridge Culture Collection for Algae and Protozoa was closed in the 1980s; the American Type Culture Collection (ATCC) protistology division has no academic program for training taxonomists. Indeed, since the "lower organisms" have been mostly orphaned from their parent zoological and botanical social institutions, almost no opportunity for advanced taxonomic training covering any major group of protoctists exists today. The only professional graduate studies that depend on expert tax-

onomic information and the ability to identify live organisms to the species level are organized around pure practicality—such as study of the plant pathogens (especially of the turf grass used in golf courses); the fossil foraminifera used—indeed, decreasingly used—in stratigraphic analysis of oil-bearing sediments; and "pathogenic protozoa" and pollution-indicating algae and ciliates likely to be found on beaches or in public water supplies.

REVITALIZING MICROBIOLOGY

To inspire microbial enthusiasm, we encourage graduate students to investigate the excitement and the complexities of microbial discovery. Students in Lynn Margulis's Symbiosis seminar wrote about one of the great unknowns in the species inventory: How many, and what, are the microbes in the digestive tracts and other body parts of animals and plants?

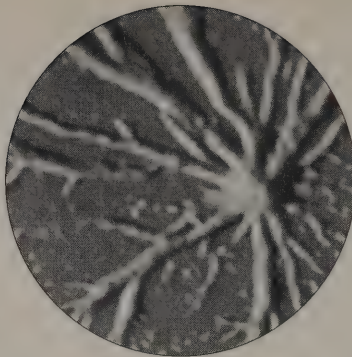
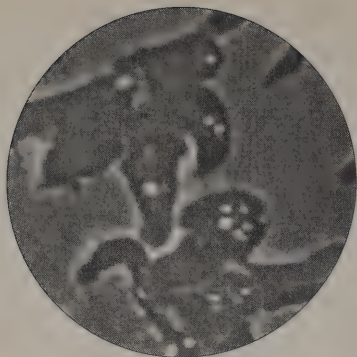
Joseph Leidy of Philadelphia (the "last man who knew everything," according to a recent biography) was the first person in the United States to ask what a termite encased in wood actually eats. From vertebrate paleontology to freshwater amoeba, Leidy, who is also credited as being the founder of parasitology in the United States, found all life interesting.

In 1881 he examined *Reticulitermes flavipes*, the eastern subterranean termite, and reported his great astonishment that the gut was "swarming with myriads of parasites," and that, "some animals are so habitually and constantly infested with multitudes of various parasites that it would appear to be their normal condition."

When the intestine of the termite is withdrawn from the abdomen and submitted to gentle pressure, under the microscope, the brownish matter in the interior is observed as a swarming mass, in which the largest parasites are distinguished pushing their way through the crowd. If the intestine is ruptured, myriads of the living occupants escape, reminding one of the turning out of a multitude of persons from the door of a crowded meeting-house.

While he went on to begin the process of naming and describing the microbes of *Reticulitermes* (*Trichonympha agilis*, *Pyronympha vertens*, *Dinenympha gracilis*), Leidy would have needed to do some experiments to realize that these parasitic protozoa are actually obligate wood-digesting symbionts of the termite. If deprived of them, the insects die, their hindguts filling up with undigested wood.

Over the years, hundreds of species of these protoctists have been described from wood-eating termites



Above: A cellular slime mold that lives in damp soil or rotting logs. It can be an independent aggregate of hundreds of amebas (left); or form a slimy mass, a "super-organism" (center); or transform into a stable reproductive body (right) that scatters spores. Its movements and spores have confounded taxonomists for a century. Of the genus *Minakatella*, it is, for the moment, classified in a phylum of Protocista.

FROM *Gaia to Microcosmos* (SEE PAGE 44).

around the world. (They're not found in the fungal-gardener soil-eating termites, mainly of the tropics). Much of this descriptive work was done by Professor Harold Kirby of the University of California, Berkeley, who described and wrote monumental taxonomic accounts of more than 100 species of them.

His work, by today's standards, was fairly straightforward. A slide-and-stain taxonomist removes the termite gut by pulling off the end of its abdomen and then gently smearing the gut contents onto a glass microscope coverslip. This specimen is then "fixed" by immersion in an appropriately noxious chemical compound, aldehyde, acid, or alcohol, or some combination of them. This preserves the specimen, preventing the cellular structure from disintegrating or rotting.

The specimen must then be stained so the little fibers and filaments and other structures characteristic of each species can be seen. The coverslips are then dehydrated in alcohol so that they can remain inert, and mounted on a microscope slide. Then the taxonomist must spend many hours obsessively studying the slides under the microscope, gently focusing up and down to see the little details, some of which can be resolved to the level of a single micrometer or two.

Finally, the taxonomist makes some lovely drawings or photographs of the new organisms, writes a paper

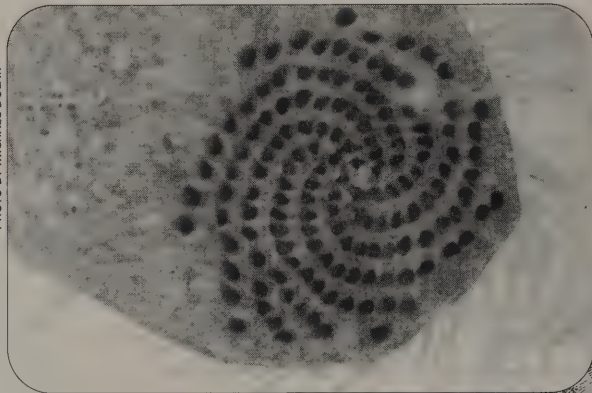
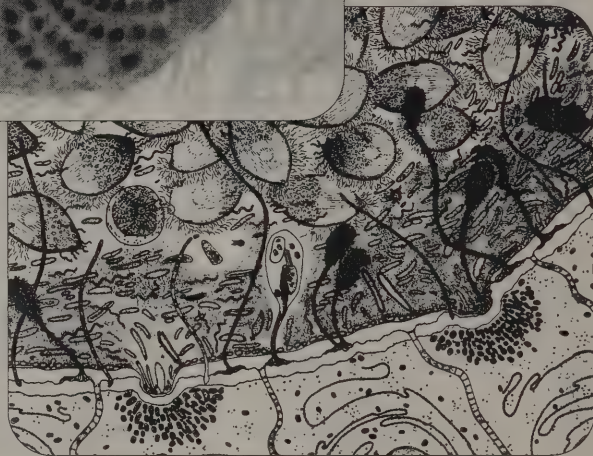


PHOTO BY MICHAEL DOLAN

Right: A bacterial community in a pocket in the hindgut wall of the Sonoran desert termite. More than 10 billion bacteria per milliliter have been found, representing 20 to 30 "strains." Notice that some bacteria line the wall; others float freely.

DRAWING BY CHRISTIE LYONS, FROM *THE MICROCOSMOS COLORING BOOK* (SEE PAGE 44).



Left: A light microscope photograph of the protocista *Metacoronympha senta*. Note the many nuclei, stained with hematoxylin to be more vivid. It lives only in a species of Florida termite, in the hindgut fluid, where it digests wood.

describing them, and deposits the slides in a museum as the type specimens, against which all others will compare their own specimens.

But because of the confusion surrounding microbial taxonomy and how to classify specimens in collections, the Linnean quest can easily suffer setbacks. When Kirby died suddenly, his 20,000 slides traveled around the country to various people before ending up in Amherst, Massachusetts in the hands of his former student Bronislaw Honigberg, who had the foresight to deposit them in the American Museum of Natural History in New York. But when

Michael Yamin, then a graduate student at Rockefeller University (he subsequently published the most comprehensive list of termite symbionts throughout the world), examined the collection, he couldn't find 1,000 type specimen slides.

After many years, Yamin finally found them. After Kirby died, he was replaced by one of his students, Bill Balamuth. When Balamuth died suddenly in 1981, his students came back to clean out his lab. One of them, Tom Gong, realized the value of Kirby's slides, saved them from the trash, and had stored them in his house near Berkeley ever since.

PLANETARY MICROBIOLOGY AND DIGITAL TECHNOLOGY

The inventory of the Earth's living creatures has been slowed by a bias toward big, charismatic, and more loveable animals and plants; and by trying to jam all organisms into two kingdoms. It has been slowed by a prejudiced filter that searches for and describes only those microbes involved in disease and medicines, or horticulture and agriculture, or eating wooden homes. Add to this still another barrier. Living beings taken out of their native places of residence do not survive long, and so methods need to be developed to preserve the salient features of their structures after death.

Back to Linnaeus, who insisted that drawings and publications about life do not properly suffice to document living forms, and that therefore "type specimens" needed to be preserved in places of higher learning. But how to best preserve microbial specimens? The old and elegant technique of the fixed and stained type-slide preparations, e.g. L. R. Cleveland (1892-1969) and Harold Kirby (1900-1952), missed too much. With the light microscope, only features bigger than about 10^{-6} meters could be seen. With scanning electron microscopes, new features as small as 10^{-8} meters, and more three-dimensional features, became visible. Membrane structures and organelles became clearer. With the transmission electron microscope, features even smaller (10^{-9} meters) became apparent, and the larger features more vivid. With protein and DNA/RNA analysis, the creature's morphology was lost but its genome(s) could be tallied to help taxonomists clarify relationships.

But all this never equalled the live images of protocists. It is life that is far more communicative and informative. Microvideo recording of all stages of the life history can reveal such taxonomic features as developmental timing, motility, sexual and


asexual acts, propagule formation, and kinetid structure, which help enormously in classifying the microbial world. The films by Cleveland, taken with the phase contrast microscope in 1956-1957, document the organisms in question in a far superior and more useful manner than slides of single life stages. If transferred to digital imagery, for instance, Cleveland's films can serve as the type material for about thirty species of unique cellulolytic microorganisms of wood-eating cockroach and termite hindgut like those first described by Leidy.

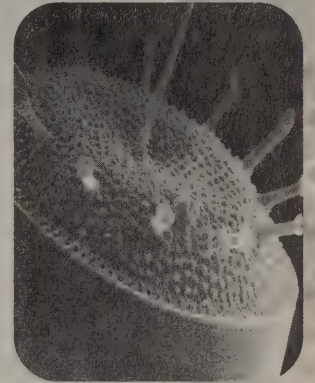
High-quality footage of the type specimens of live organisms would help investigators more easily resolve the rampant taxonomic disputes and confusion. Does *Takakia* belong in the phylum bryophyta or does it deserve higher taxonomic status on its own? Should the fungi *Candida* and *Taphrina* be placed into the phylum Asco- or Basidiomycota? Or, should the Irish potato blight, *Phytophthora infestans* (an oomyceti) be properly classified as a protocist, not a fungus? While perhaps sounding obscure to those only familiar with charismatic species, these questions are at the heart of Linnaeus's passion to bring order and harmony into our knowledge of all life.

Wissenschaftlichen für Film (IWF, Göttingen, Germany), has made an unprecedented beginning in this endeavor. They should be financially and intellectually supported by the international community of scholars. Their pristine insistence on live material only, with an absolute minimum of interpretation, should be emulated worldwide. Their work deserves coordination with all organizations dedicated to the completion of the Linnaean task.

In the present world, replete with computers and CD-ROMs, primary science could wonderfully avail itself of the use of the film-to-video-to-digital transfer and video technology itself. The deposit of original footage (or digital copies) as biological "type

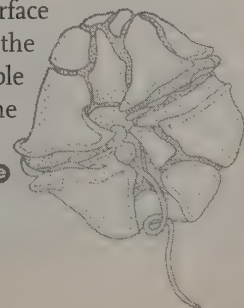
material," subject to international standards and review by appropriate taxonomic experts, would accelerate the spread of biodiversity knowledge and the accomplishment of an inventory of all species. At thirty frames per second, five to ten seconds per scene, and approximately ten minutes per species, the amount of high quality taxonomic information that can easily be stored on disk would be immediately increased by a factor of about 100,000 (the estimated increase over the usual ten photographs per monograph).

Our knowledge is very poor. The odd collection of microorganisms in the Kingdom Protocista may include anywhere from 210,000 species to 1.2 million. Only 80,000 have been described. The difficulty of handling this diversity of nucleated organisms that are "too large" and "too irrelevant" to be of interest to bacteriologists and "too small" and "too confusing" to concern zoologists and botanists is stunning. The serious accomplishment of the dream of Linnaeus will require a political will, ingenious organizational skills, compromise, commitment, and international collaboration that is unprecedented among biologists. Reminiscent of the kinds of coordination required to return a spacecraft from Mars, this inspiration, the Linnaean mega-effort, would do well to imitate the techniques of the metanational "Big Science" organizations that successfully rendezvoused the Comet Halley, installed the Deep Space Net monitoring system, and mapped the surface of Venus in the radar and visible regions of the electromagnetic spectrum. 

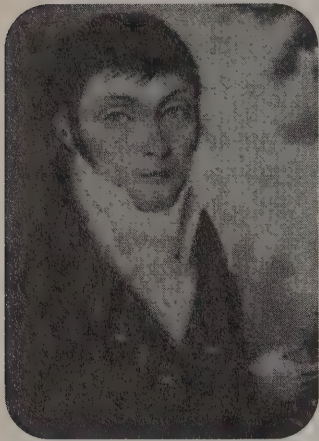


Thalassiosira nordenskjoeldii, a marine diatom from the Atlantic Ocean.

PHOTOGRAPH FROM FIVE KINGDOMS (SEE PAGE 44).



THE GULLIBLE *Genius*



Thomas Birch's drawing of the young Constantine Rafinesque.

FROM A SPECIES OF ETERNITY (SEE OPPOSITE PAGE).

One day while walking by the river, Audubon noticed a man landing with what seemed to be “a bundle of dried clover” on his back.

“What an odd-looking fellow,” said I to myself. He ascended the banks with rapid step then asked if I

could point out the house where Mr. Audubon lived. “Why I am the man,” I replied. The traveler rubbed his hand with delight while I broke the seal of a letter of introduction that he handed me: “My dear Audubon, I send you an odd fish which you may prove to be undescribed...” With all the simplicity of a woodsman I asked the bearer where the “odd fish” was. Again he rubbed his hands and with the utmost good humor said: “I am that odd fish, I presume!” I felt confounded and blushed but managed to stammer an apology to that renowned naturalist. Constantine Rafinesque himself.

Years later, in an episode of his *Ornithological Biography* entitled “The Eccentric Naturalist,” Audubon was gleefully recalling how he had met one of the most sophisticated scientists of the day and made him the butt of his backwoods humor.

...A long loose coat of yellow nankeen cloth—stained all over with the juice of plants, nankeen waistcoat over a pair of tight pantaloons. His beard was long, his lank black hair hung loosely over his shoulders. His words afforded a sense of rigid truth. I listened with as much delight as Telemachus could have done to Mentor. I laid my portfolios open before him. He turned to the drawing of a plant quite new to him, inspected it closely, shook his head and told me no such plant existed in nature. I told my guest the plant was common in the immediate neighborhood. He importuned: “Let us go now.” We reached the river bank and I pointed to the plant. I turned to Rafinesque and thought he had gone mad. He

began plucking the plants one after the other, danced, hugged me, told me exultingly that he had not had merely a new species, but a new genus.

That night Audubon heard a great uproar from the naturalist’s room. “I opened his door and saw him running about naked in pursuit of bats. He had my favorite violin by the handle and proceeded to bash it against the wall in an attempt to kill the winged animals. He begged me to procure a bat for him—‘a new species.’ I took the bow of my battered Cremona violin, and soon got specimens enough.”

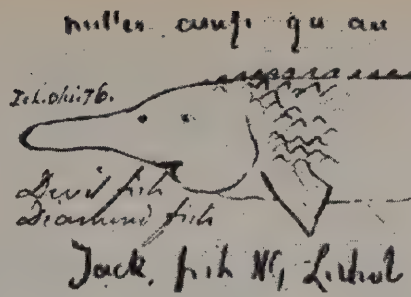
At Rafinesque’s request, Audubon took him out into

one of those thickets or brakes in which the cane grows from twelve to thirty feet in height. A fallen tree obstructed our passage. We were about to go round it when out of the center of the tangled mass of branches sprang a bear with such force and snuffing the air in so frightful a way that Rafinesque was terrified. In his haste to escape he fell and was pinioned between the stalks. Despite his thorough fright, I could not refrain from laughing at the ridiculous exhibition he made. The way became more and more tangled. The thunder began to rumble. Heavy rain drenched us. Briars had scratched us, nettles stung us. Rafinesque threw away all his plants, emptied his pockets of fungi, lichens and mosses. I led him first one way, then another until I myself, though well acquainted with the brake, was all but lost in it. I kept him stumbling and crawling until long after midday.

Leading his guest through the canebrakes was cruel enough but even crueler was a scientific hoax Audubon played on him, describing and drawing a dozen local fish which never existed except in his own tall tales. Taking Audubon at his word, Rafinesque included ten of Audubon’s imagined creatures in his pioneering work on western fishes.

The Devil-Jack Diamond fish (*Litholepsis adamantinus*) [Rafinesque wrote], the wonder of the Ohio. I have seen it but only at a dis-

tance and have been shown some of its singular scales. Wonderful stories are related concerning this fish but I have principally relied upon the description and figures given me by Mr. Audubon. Its length is 4 to 10 feet. The whole body is covered with large stone scales half an inch to one inch in diameter. They strike fire with steel! and are ballproof!...



ored drawings.” Rafinesque seems never to have read Audubon’s account of the visit, and may never have been aware of the fishy hoax. The waters of the Ohio were unusually low and revealed to his delighted eyes a host of univalves nobody had ever collected....When he had finished his trip, Rafinesque totted up his claims: “Abt. 25 new species of Bats, Rats and other quadrupeds, abt. 20 N. Sp of Birds. Abt. 15 N. Sp of snakes, turtles, lizards, and other reptiles, 64 N. Sp of many fossils. And in Botany I have collected more than 600 Sp of Plants of which one-tenth part at least are new.”...

While at the university [of Transylvania], he completed his *Ichthyologia Ohiensis*, or *Natural History of the Fishes Inhabiting the River Ohio and Its Tributary Streams*. A pioneer work in its field, it is an engaging book, explaining much about Rafinesque as well as about the Ohio’s fishes. “The art of seeing well or of noticing and distinguishing with accuracy the objects which we perceive is a high faculty of the mind,” he wrote. This faculty, he went on, aiming at his deprecators, is “unfolded in few individuals and despised by those who can neither acquire it nor appreciate its results.”

In *Ichthyologia Ohiensis* he writes succinctly, with careful attention to detail—a reader can almost smell the air and earth, taste the waters, see the “very fine views and prospects.” The fish are described mostly in English, not Latin, since the intention was to make it easy and attractive for laymen. The fishes’ common names are given along with instructions on where and how to catch them (the golden-eye

perch “bites at the hooks”), how to cook them, how they taste (“Most delicate are the salmon-perch, the Bubbler, the Buffalo fish, the sturgeons, the catfishes”). Like William Bartram, he was as ravished by the coloring of a fish as any ornithologist by the plumage of a bird. The Ohio goldshade, he wrote, “is greenish gold above, silvery underneath, blue under the scales, sides, belly and throat with purple and violet shades. Top of head and neck clouded with brown, eyes black, iris silvery and gilt.” Besides all this, it is “a fine fish, flesh esteemed, less bones than the shad.” He had an eye—and ear—for the grotesque. He described the Grunting Bubbler crunching shellfish in its teeth and uttering a “strange grunting noise between the dumb grunt of a hog and the single croaking noise of the bull-frog. Every navigator of the Ohio is well acquainted with it.”...

Had he been less haphazard in publication and more organized in his presentations, Rafinesque would have received more credit during his life and saved other scientists from going over ground that he had already covered. Naturalists since his death have kept rediscovering Rafinesque, sorting out his wild claims from his provable achievements, and finding more and more of the latter. In ichthyology, Rafinesque is now given credit for discovering or first identifying thirty-five genera and thirty species, far more than any other American of the period. In mammalogy, he is credited with six genera and six species; in botany, with some seventy genera and as many species. **WE**

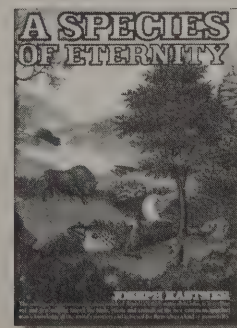
Left: Rafinesque’s diligent notebook drawings of Audubon’s nonexistent “devil fish,” which Rafinesque believed to be a new species.

FROM A SPECIES OF ETERNITY.

He was only an embryo eccentric when, in 1802, he first came to America. He was twenty years old....A precocious student, he had read a thousand books by the time he was twelve years old and was a knowing naturalist when he first came ashore in Pennsylvania in 1802. The shock of discovery hit him, as it had Banister and Kalm and Wilson and all the others. “Everything was new to me,” he recalled, including a plant he described as a new species and named *Draba americana*. “American botanists would not believe me,” he grumbled, and they discarded his discovery only to have it verified decades later....

...Following his precept that anything anyone else could do Rafinesque could do better, he branched out into archaeology and volcanology and began reordering Linnaeus’s classifications of fish. The local fishermen were agreeable to saving “the offal of their nets” for him and in these discards Rafinesque found dozens of new species. His careful way of describing the fish in their still-living colors confused other ichthyologists who, seeing only dead, faded specimens, concluded that Rafinesque was imagining the creatures he described....

...Rafinesque in 1818 started the American wanderings which were to take him back and forth across the Alleghenies five times, mostly on foot. “Horses do not suit botanists,” he declared....At Henderson, his autobiography notes, he “spent some days with Mr. Audubon, ornithologist, who showed me his fine collection of col-



Excerpted from *A Species of Eternity* by Joseph Kastner. Copyright © 1977 by Joseph Kastner. Reprinted by permission of Alfred A. Knopf, a Division of Random House, Inc. Best intro to America’s first maniacal naturalists. Get this book back in print!

THE RIVERS OF *Marmosets*



A Brazilian caboclo's *jeitinho*

("little thing") becomes a Dutch

family's Dreumes ("Little Fellow")

becomes science's new species

—*Callithrix humilis*, the dwarf

marmoset of the Amazonas



BY DAVID QUAMMEN

All Illustrations

by Stephen D. Nash

Conservation International

The story begins back in April, 1996 when a strange newcomer arrived at the Van Roosmalen household in the Brazilian city of Manaus, the gateway to the Amazon. The newcomer, though as tiny as a mouse, was a baby monkey—but not precisely like any monkey that Marc Van Roosmalen had ever seen.

Knowing that Marc and his wife, Betty, maintain a rearing facility for orphaned primates, a certain caboclo (a backwoodsman of mixed white and Indian blood) offered them the animal for adoption. It had been captured somewhere up in the Rio Madeira drainage, he said, and brought down aboard the ferry from Manicoré, 300 miles to the south. It was evi-

dently a pygmy marmoset, judging from the size. There was only one species of pygmy marmoset known to science: *Cebuella pygmaea*, the most diminutive of all South American primates. Although its geographical distribution is strictly bounded—it inhabits a vast area stretching west from the Madeira but has never been recorded on the river's east bank—it's fairly abundant within its native range, especially along riverbanks and the edges of settlements. It doesn't seem to suffer badly from human hunting, because it's too small to be worth killing for food. It belongs to the family of callitrichids, which also encompasses the larger marmosets and the tamarins.

The Van Roosmalen menagerie already harbored

Above: The dwarf marmoset as it develops: one month, two months, seven months, and adult (not to scale). Its black crown, lack of territory, tinniness, and white lower cheek hairs are diagnostic. Its range is the smallest of any known marmoset.

several *Cebuella pygmaea*. Betty, who does much of the caretaking, was reluctant to accept another. But the caboclo brought it by anyway: a pathetic little creature inside an empty milk can punched with airholes. Its shrill squeaks of distress resembled the chirps of a cricket. It seemed destined to die soon, as most orphaned monkeys do.

When the caboclo opened the can, Marc says, "I saw immediately it was not a common marmoset." This animal had a white border of fur around its face and a black crown, both of which distinguished it from *Cebuella pygmaea*. Its mane was shorter. Its ears were more naked. Its tail was black and unringed instead of brownish and ringed. "I didn't show any excitement," Marc says, though he felt plenty, "because the guy maybe wouldn't have given it to me."

Betty named the new animal Dreumes, Dutch for "Little Fellow," and began rearing him on a diet of yogurt and honey. Several weeks later, when Conservation International president Russ Mittermeier came down to Manaus for a meeting, Marc showed him the crown-headed baby to get a second opinion. As Mittermeier recalls, "I took a look at it and said, 'It's new!'"

That novelty seemed more than a little remarkable. Only about 240 species of primate exist in the world, and finding a new species anywhere would be an important scientific event. Barely more than a handful have been discovered in the past decade, and those only because of increased attention by scientists at work in remote corners of the last great strongholds of tropical rainforest, such as Madagascar and Brazil.

Both Mittermeier and Van Roosmalen have devoted close study to the callitrichid family, which contains about thirty species of marmoset and tamarin spread across Amazonia (a 2.7-million-square-mile area that covers much of northern Brazil and parts of eight other South American countries) and the Atlantic coastal forest of southeastern Brazil. "You see one that's different," Mittermeier says, "and it jumps out at you and says, 'Hey, look at me!'"

What he found himself looking at was a perplexing form: an unfamiliar animal combining a mix of familiar traits, both physical and behavioral, that seemed to put it somewhere between the pygmy marmoset, which is roughly the size of a chipmunk, and the full-sized Amazonian marmosets of the genus *Callithrix*, which are the size of squirrels. "All the marmoset people are gonna go nuts when they hear about this thing," Mittermeier said. "Because it's basically the missing link—between *Cebuella* and *Callithrix*."

Why should that linkage drive anyone nutty? Prevailing opinion holds that the callitrichids are the

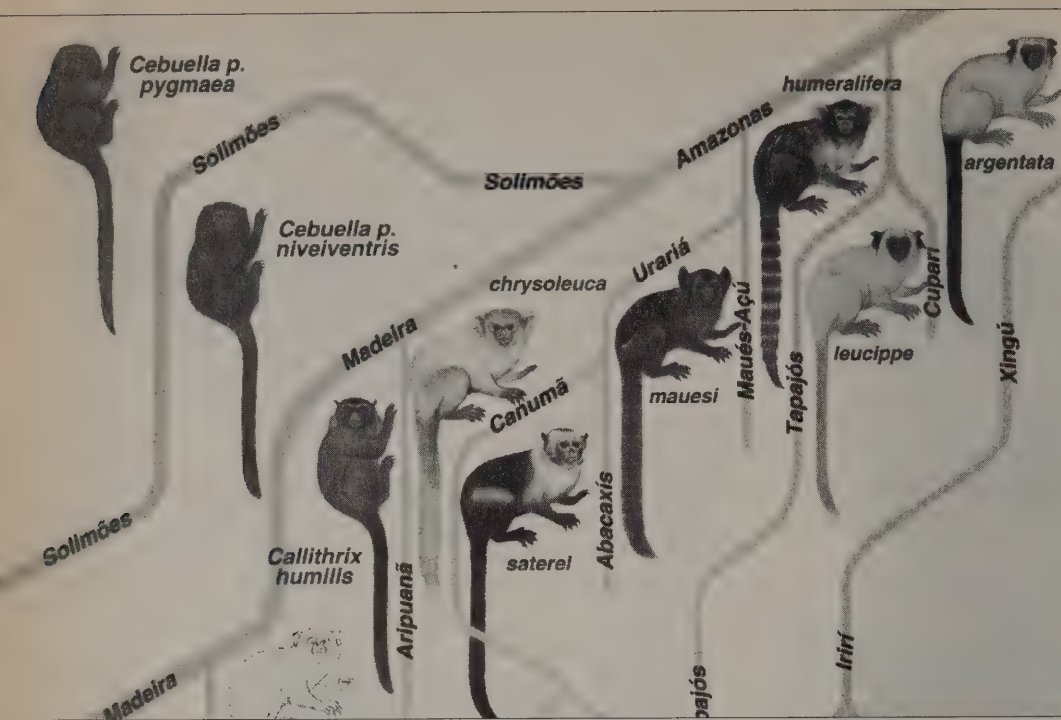
most primitive of all South American primates—that they're less intelligent or less equipped for survival, but merely that they have retained more of their basic ancestral design. Furthermore, *Cebuella pygmaea* is considered the most primitive of the callitrichids, representing an early form from which all those larger monkeys descended. If Van Roosmalen's pygmy marmoset is really a missing link, it embodies transitional attributes that might lead to fresh insights on primate evolution in the Americas. But it also presents a fresh mystery: Why has this link been missing? If *Cebuella pygmaea* has thrived throughout a large region west of the Rio Madeira, and the *Callithrix* lineage has expanded and diversified throughout a large region east of the Madeira, where has the intermediate species been hiding?

The next step for Van Roosmalen was to trace Little Fellow back to its native home. With money obtained by Mittermeier from the California-based Margot Marsh Biodiversity Foundation, Van Roosmalen launched a search expedition in July. His teenage son, Tomas, a precocious naturalist, accompanied him, as well as a burly, capable, boat jockey and all-purpose expedition wrangler named Valquemar Souza de Araujo, who chose amiably to be called Gordo, meaning Fats. Starting in Manicoré, they explored the neighboring areas in a rented speedboat, visiting riverbank settlements and showing photos of Little Fellow to the caboclos there, asking hundreds of people if they had ever seen any such monkey. Many said yes—"Tem muito, tem muito," meaning, "There's plenty"—but it became clear that they didn't distinguish between Little Fellow and other native marmosets of the region. When the team tried to substantiate each report with their own forest observations, all they saw were the familiar pygmy marmoset on the west side of the Madeira and the familiar full-sized marmosets on the east side. After two weeks they returned to Manaus, frustrated.

They had hoped, too, that they might find another of the new animals in captivity and be able to ransom it as a mate for Little Fellow. No luck with that, either. Meanwhile, Little Fellow had survived infancy and entered adolescence, changing his color pattern



The pygmy marmoset lives just on the other shore of the Madeira River but is a different species. Pygmy marmosets have a lion-like mane, ears hidden in fur, rings on their tail, and no black on their crown. The pygmy is territorial; the dwarf is not.



Marmosets are reproductively isolated by rivers. The dwarf marmoset (*C. humilis*) dwells in the "island" between the Aripuanã and Madeira river channels. The sketched marmoset in the lower left is either a race of the dwarf or still one more new species. Fourteen to sixteen species of marmosets dwell in the Amazon, one of the richest areas for primates on the planet, and new species continue to be found.

slightly but remaining distinct, growing into a creature for which primate taxonomy had no slot or label.

In November, Van Roosmalen and Gordo tried again. Again they went upriver to Manicoré, and again they found only familiar marmosets. This time on a return trip they stopped at another town, Novo Aripuanã, about a hundred miles downriver, near the confluence of the Madeira and a tributary, the Rio Aripuanã. Maybe, Van Roosmalen guessed wildly, Little Fellow had been brought down this river before being put aboard the ferry. Maybe they should go up and snoop around. Gordo concurred: He had a *palpite*, an intuition that they'd find the monkey up there. So they rented another speedboat to explore the Rio Aripuanã. Along the east bank, they found only familiar marmosets, but from the young wife of one caboclo they heard that, near her father's settlement, on the west bank, lived some tiny monkeys.

They hit a rainstorm on the river; they ran out of gasoline; everything seemed to be going wrong. But Gordo was still talking about his *palpite*. "We find him now," he said. "You will see. Fifty minutes from now, we find the monkey." They docked at the place

they'd been directed to. The two men climbed a high bank to a cluster of simple caboclo houses and met the patriarch of the settlement, Antônio da Silva Periera, a short man with a quiet smile, thick arms, and a sparse salt-and-pepper beard. For the umpteenth time, Van Roosmalen described the object of their quest. One of Periera's grown sons said, "Come, there's a little monkey like that right near my house." The son led the way to a recently cut-and-burned clearing, at the edge of which stood a forked tree, its two slender trunks rising from a pile of dried slash. "And then I saw them," Van Roosmalen recalls.

He saw a family group of four or five animals, all looking very much like Little Fellow. They skittered up and down the trunks, paused, lowered their faces to nibble carbohydrate-rich sap from pock-rimmed holes they had gouged through the bark. That behavior was characteristic of the common pygmy marmoset. But these animals had an uncommon appearance. Their tails were long and dark. Their ears, naked. They had crowns of black fur. They weren't *Cebuella pygmae*; then again, they weren't some sort of known *Callithrix* species. They were only themselves, a new and confusing

piece in the puzzle of Amazon primate evolution.

Less than two weeks after hearing about Van Roosmalen's find, Mittermeier was back in Manaus. And now I was with him, equipped with malarial medicine, rubber boots, insect repellent, a first-aid kit, tropical-weight field pants, a water filter, and a folding knife.

I already knew we would revisit the site where Van Roosmalen had glimpsed the new monkey—to confirm the animal's uniqueness (we hoped) and to capture its image on film—and then do some scouting in adjacent areas. We'd fly to a small airfield upriver on the Madeira and proceed onward by boat. Beyond that, the details were blurry.

Be prepared to travel light and rough, Mittermeier had warned me by telephone, and if I had any special medical necessities, he said, "better bring them yourself. This will be one of my usual shoestring operations. Take aspirin, tincture of opium, and hydrogen peroxide, and that's it." Peroxide for dousing external infections and aspirin for minor pain. The tincture of opium might be useful, I supposed, for despair.

Amazonia overall contains great primate diversity—a great gumbo of marmosets, tamarins, howler monkeys, spider monkeys, night monkeys, squirrel monkeys, woolly monkeys, and capuchins, among others, amounting to at least fifty-eight species, not counting the new one. The significant boundaries, as far as primate evolution is concerned, are not the surveyed borders, but the big rivers. Since most monkey species are disinclined to swim, they seldom cross rivers except by perilous happenstance. So the three main waterways of the western half of the Amazon—the Madeira, the Rio Negro, and the main-stem Amazon (known in Brazil as the Solimões), which converge near Manaus—isolate wedges of habitat almost as effectively as the Pacific Ocean isolates the Galápagos Islands. Isolation is conducive to the evolution of new species,

so the various wedges harbor different sorts of monkeys.

This insight has an interesting history. In the mid nineteenth-century, an intrepid English naturalist named Alfred Russel Wallace noticed the isolating effect of these rivers and described it in a paper titled “On the Monkeys of the Amazon,” published five years before Charles Darwin’s *The Origin of Species*. The Amazon monkeys provided one pattern of data among many that led Wallace, after further years of field work and a near-fatal shipwreck, to his theory of evolution by natural selection. It happened to be the same theory as Darwin’s, and it was propounded in a manuscript that Darwin saw before his own book went to press. Amazon monkeys and the rivers that isolate them hold special status in the saga of evolutionary theory. And that saga continues today.

Mittermeier was bent eagerly over the map. “This is a hotbed of evolution,” he said, circling his finger around an area along the lower Rio Madeira. “It has the greatest concentration of new primates found in the second half of the century. He was referring in particular to the marmosets, to which those four new species recently were added and another three or four may soon be confirmed. Mittermeier had cowritten the formal description of one of the new marmosets. But his role in such dry, taxonomic documentation hadn’t dimmed his explorer’s enthusiasm. “It’s just unbelievable,” he said, putting his hands to his head.

“But the star of the area is this *Cebuella*,” he added, meaning Van Roosmalen’s pygmy marmoset,* still so new that it had no species name of its own. Its star quality derives partly from its position in the primate family tree, partly from its position in geographical space. The matter of geographical space brings us back to a question posed earlier: Why has the new species remained undiscovered until now? The answer seems to be that it was easily overlooked because it occupies only a miniscule geographic area, a little triangle of habitat between

the Madeira and the Rio Aripuanã, possibly the smallest distribution of any Amazon primate. That answer leads toward all sorts of complex ecological factors—including competition between closely related forms, and barriers to travel—that can restrict a species from extending its geographical scope. It also raises another simple question: How did the pioneering ancestors of Little Fellow ever cross such a formidable barrier as the Rio Madeira?

There’s more to that barrier than the problem of a long-distance swim. In fact, Mittermeier said, we’d have to be wary of swimming in the Madeira ourselves. During most trips like this, Mittermeier indulges himself at the end of each sweaty workday with a dip in whatever stream is nearby. You watch your step, shuffle your feet in the shallows to avoid stepping on a stingray, don’t swallow a mouthful downstream from a village, and generally you’re okay. But not in the Madeira. No thanks—not this stretch of it, anyway, known to harbor an unholy abundance of black caimans that make the Madeira a river of no mercy.

Next morning we flew south out of Manaus, following the wide, brown Madeira upstream to its junction with the Aripuanã. The farther we got from Manaus, the less evidence we saw of human presence. “There’s nobody here,” said Mittermeier, who has seen more than his share of heavily logged and settled rainforests. “This is still one of the great wilderness areas of the world.” In less than an hour we landed on a red-clay airstrip at Novo Aripuanã, where at least one symptom of human impact was manifest: dozens of black vultures circling over the town dump.

Gordo met us at the dock. He loaded our gear into a small aluminum boat mounted with a Yamaha 25-horsepower outboard, and we all climbed aboard. We passed through the mixing zone, at the confluence of the two rivers—that stark interface where the dark tea of the Aripuanã (a “blackwater” river in Amazon terminology, darkened by tannins and other chemicals from decayed vegetation) meets the silt-laden water

(turbid brown, though the terminology calls it “whitewater”) of the Madeira.

The Aripuanã is a peculiar river, striated with long, thin islands that stretch in some cases for miles and aren’t recognizable as islands except at either end. The shape of the islands is related to the fact that the Aripuanã drains an extremely flat basin. That flatness, besides contributing to slow flow, prolonged seasonal flooding of the lowlands and the leaching process that blackens the water, also results in occasional shifts of current to one side or another of a low strip of land, continually creating and abolishing long channels. A strip of terrain once connected to the west bank might find itself insulated in the middle of the river and, still later, subsumed into the east bank. Plants and animals inhabiting that strip might find them thus transferred from west to east. It’s a magical sort of dry-shod crossing that’s less apt to occur on a whitewater river like the Madeira, which flows too fast and heavily for such general meandering.

How could a monkey ever cross the Madeira? How could the ancestors of Little Fellow have gotten to the east bank of the river, where they first became isolated from the larger population of *Cebuella*? One possible answer is what Mittermeier and others call “the waifing hypothesis.”

The hypothesis derives its plausibility from two aspects of pygmy marmoset behavior: They live along riverbanks, where periodic flooding causes drastic erosion, and they sleep in tree hollows. If a family of pygmy marmosets were sleeping in a tree hollow on the Madeira’s west bank when that tree toppled into the current, they would wake to find themselves waiflike castaways on a floating log. If the log water washed up against another bank, they probably would jump ashore. If it happened to be the east bank, they would have achieved a safe crossing of that seemingly merciless river.

This is the hypothesis that Mittermeier and Van Roosmalen favor. Erosion, chance and behavioral traits combined to transfer Little Fellow’s

*Since David Quammen wrote this story, “this *Cebuella*” has been identified as a *Callithrix*, and “Roosmalen’s pygmy marmoset” has been named “the dwarf marmoset.” —Ed.

ancestors east of the Madeira; the Madeira and the Aripuanã kept them isolated in that little triangle of habitat; time and evolution did the rest.

“Finding a new monkey in this is like finding a needle in a haystack,” Mittermeier said. “A very large haystack. And a very small monkey.”

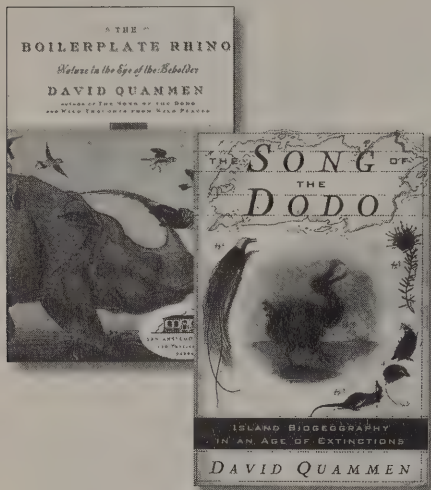
For miles, unbreached curtains of green. Finally on the right appeared another clearing, with a handful of

houses atop a high bank, a tall forked tree standing just at the brow of the bank.

We climbed the bank, paid our respects to Antônio da Silva Pereira, followed Van Roosmalen to the tree and beheld four little monkeys darting up and down its trunks, which were marked with pock-rimmed holes. They were barely bigger than chipmunks. Their ears were naked,

their faces were pink. They paused at one hole or another, eating sap. They glanced occasionally toward us as we stood in plain sight with our binoculars deployed and our cameras crackling, but they didn't show much concern. They made chirping noises....

We had our success, confirming the existence of an intriguing new species. **we**



THE BOILERPLATE RHINO

Nature in the Eye of the Beholder
David Quammen. 2000; 287 pp. \$24.
Scribner.

SONG OF THE DODO

Island Biogeography in an Age of Extinctions
David Quammen. 1997; 704 pp. \$18.50.
Scribner.

Quammen is America's most vivid essayist and interpreter of biology and conservation biology. *Dodo* hones in on small, isolated, insular locales—lonely islands, lakes, and alpine mountain tops where myriad species evolve and where invasive domestic pigs, human hunters, climate change, imported disease, and competitors bring about abrupt

extinctions. Darwin, Wallace, and MacArthur/Wilson (in their controversial book on island biogeography) are major heroes of *Dodo's* yin/yang of diversity/homogeneity, with its wonderfully wrought tales of extinction (dodos), near extinction (komodo dragons, indris, the snake invasion of Guam) and maybe recovery (Mauritius kestrels).

The Boilerplate Rhino is a potpourri of encounters between humans and an overwhelming variety of creatures, revealing all the gray matter and in-your-face complexities of human and non-human lives. Rattlesnake hustlers, the quest to make *T. rex* Montana's state bird, God's love of beetles, you catch the drift. Finally, muscular smarts plus curve-ball humor in writing about the planet. —PW

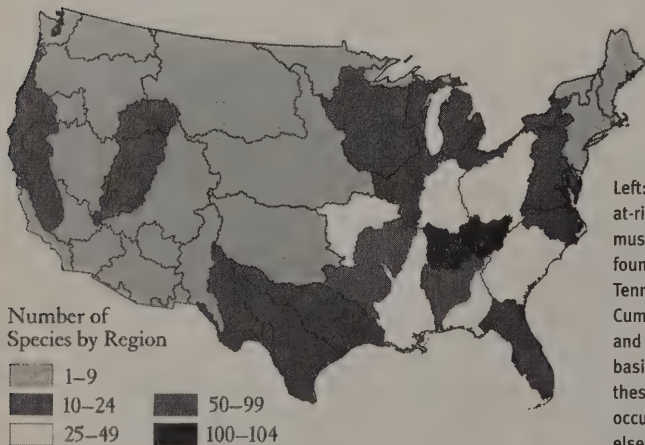
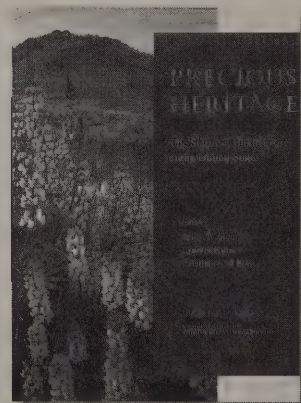
PRECIOUS HERITAGE

The Status of Biodiversity in the United States
Bruce A. Stein, Lynn S. Kutner, and Jonathan S. Adams, eds. 2000;
399 pp. \$45. Oxford University Press.

Precious Heritage is the first and best book covering biodiversity in the US. While not covering ALL species, no other effort, besides

England's, has collated so much data, made so many accurate maps, and conducted so many focused inventories. More than 900 employees in Nature Conservancy's Natural Heritage Network and the Association for Biodiversity Information, as well as thousands of biologists, generously contributed to the databases

and fieldwork. The text is clear, detailed, and school-bookish. The photos are small and beautiful. There is a great chapter on public/private land ownership and conservation. No other book or nongovernmental project with private/public funding has done so well at describing the discovery and protection of the discovered. —PW



Left: 35% of US's at-risk fish and mussel species are found in the Tennessee-Cumberland and and Mobile River basins. 70% of these species occur nowhere else in the world.



Kalmia, the genus for mountain laurel (left), was named in honor of Linnaeus's disciple Peter Kalm, who journeyed to North America in 1748 and took back many new plants to Europe.

RAPID ASSESSMENTS AND HOTSPOT SURVEYS

Given the species holocaust, some conservationists feel there is just not enough time for a twenty-five year all species inventory. Too much will be lost while learning all the species.

The two best “quick and dirty” techniques—rapid species assessment and focused inventories—speed past the complexities of a meticulous all species survey. Conservation International employs rapid assessment (RAP, see below) in which four or five experts “do” areas in three to five weeks. The Nature Conservancy National Heritage Network’s Rapid Ecological Assessment (see *Nature in Focus*) is slower; a report takes a year to complete. It relies on aerial and satellite imagery, collates existing data into computerized databases, and does focused inventories in targeted areas. The two techniques have contributed to the most significant wildlands preservation by nongovernmental organizations and public/private funding.

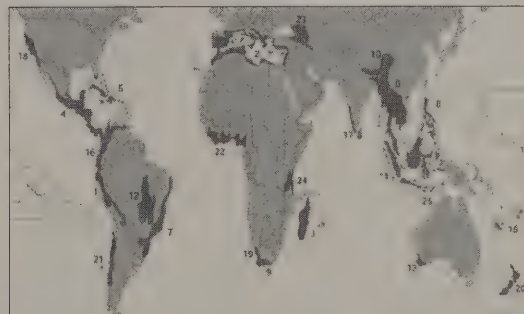
Some conservationists feel the all species inventory is a kind of perfectionism that can play only a minor role in times of calamity like ours. All species champions reply: Try everything at once! Look for funding in arenas that do not compete, but can actually complement; understand the long view of cultivating conservation, the twenty-five years. Parallel projects can nurture, not exclude, each other.

How can an all species survey complement rapid assessment and focused surveys? It can discover seasonal species, or species absent if the rapid survey occurs in an extreme dry or wet year. It can find special, mini-hotspots of soil or rocks or water features that nurture unique life-forms. It might look at single-cell life-forms, “algae,” or “protozoans,”—two kingdoms whose

inclusion could change assessments of overall value.

Fast methods have usually led to smallish conservation areas, especially in the United States. An all species survey will increasingly define the distribution of life-forms on the planet and indicate where perhaps hundreds of square miles of wildlife corridors and stopovers may be important. RAP rarely has time to employ parataxonomists and other locals; the all species survey must build local capacity (and with it a conservation ethic) in the nations where it works. Long-term goals such as creating a World List of Species database and a collections database, and establishing and maintaining herbaria, museums, and parataxonomy schools accompany the all species survey. Finally, the rapid assessment focuses on “hotspots” (see caption) in hope of protecting the most in the least time. An all species survey can help discover hotspots that have been missed, especially areas of very localized species.

Philanthropists will decide which is closer to their hearts, which they wish to be a part of. Rapid land-saving and all species surveys can accomplish different conservation goals, on different time scales, with felicitous cross-fertilizing. —PW



HOTSPOTS

Conservation International focuses on “hotspots” (darker areas) which it believes have the richest biodiversity. It’s a controversial approach because it can miss restricted species (endemics), fungi, and simpler organisms. Others, for instance, would find, in huge parts of Africa, “hotspots” that are not included here.

RAPID ASSESSMENT PROGRAM

RAPID ASSESSMENT PROGRAM (RAP)

www.conservation.org/RAP/rap_main.htm

Conservation International (CI) created RAP in 1990 to quickly provide biological information in order to catalyze conservation action and improve biodiversity protection. RAP concentrates on larger animals and vascular plants. Frequently in a race against imminent forces of destruction, such as logging and mining, small RAP teams of expert interna-

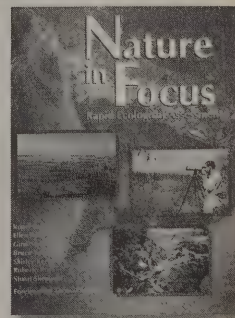
tional and host-country field biologists conduct first-cut assessments of the biological value of selected areas over a short time period (three to five weeks). CI then follows up with practical recommendations for conservation action before further biodiversity loss occurs, working with international policy makers, conservationists, NGOs, and decision makers in local government. These recommendations are based on as sound evidence of the area’s biological diversity as can be gar-

nered in such a short time (along with a literature review). RAP looks at endemism, uniqueness of ecosystems, and risks for the plants and animals surveyed. One four-day trip to Colombia’s Choco found ten new reptiles and amphibians. In less than five weeks in two coral reef areas of Papua New Guinea and Indonesia, forty new coral species were found. CI’s RAP assessments have led to six protected areas, covering eight million acres.

NATURE IN FOCUS Rapid Ecological Assessment

Roger Sayre, et al.
2000; 182 pp. \$32.50.
Island Press.

The best book on rapid ecological assessment, produced by the Nature Conservancy. The book emphasizes partnerships with local scientists and capacity building. —PW



unlikely that any other ornithologist would have noticed that the flycatcher's call sounded different from other *Tolmomyias* flycatchers.

[Parker's colleague John] O'Neill had discovered his first new bird twenty years earlier, and by 1983 he'd been involved in the discovery of ten new species. Several other people at LSU had authored or coauthored descriptions of new birds, as had John Fitzpatrick and E.R. Blake at the Field Museum. Even a missionary in Peru, Peter Hocking, had coauthored one of the Field Museum discoveries. Today, Parker freely admits how badly he wanted to find a new bird.

"The frustrating thing is that over the years each time I found a bird that I didn't know, down deep I'd feel, Oh my God, this is it. And that happened a lot the first years. I found all sorts of new species and then I'd get back to camp and I'd look through the book and..." His voice trails off, registering the inevitable disappointment. "So one by one all my new species dissolved. So I gave up. I realized there was no way you could guess when you're going to find something. And most of the people at LSU who have found things have just stumbled on them—had no idea what they were. A number of them were identified really when they were brought back to the museum."

So Parker filed his tape recordings away, then forgot about it for a while.

Six months later, not having heard or seen the bird again, he'd put it out of his mind even though he was once again in northern Peru, this time leading a nature tour. His group had just spent a few days at a lodge about fifty miles south of the Sucusari camp where he had first heard the unknown flycatcher. The group was getting settled into a boat that would take them back to Iquitos when photographer John Dunning approached Parker with a small bird in his hand. Dunning had been photographing the birds of South America for years by catching them in mist nets, taking a picture, then letting them go again, and many times he had sent pictures to Parker, who helped him identify a bird he was unfamiliar with. Dunning handed the bird to Parker, asking him what it was. Parker remembers:

"Everyone was standing around us, and I looked and it just didn't quite register. We were in a hurry and it was obvious I couldn't just squeeze this bird in front of everyone, so I said, 'Well, I'm almost sure it's an immature Gray-crowned flycatcher.' And I gave it back to him and we left."

The Gray-crowned flycatcher (*Tolmomyias poliocephalus*) has an olive-green back, gray cap as the name suggests, a pale yellow to olive breast, and a dark eye with an eye ring. But the bird's range extends from as far north as Venezuela south to Bolivia and from Ecuador east along the Amazon to eastern Brazil. Within this range its features vary, adding to the difficulty of making a quick, certain identification. The bird Parker was looking at had a "pale buff wash across the breast" and a "distinctive facial pattern with pale cheeks and an orange eye," not quite right for the Gray-crowned flycatcher, but these are the kinds of differences that one might note in an immature bird. An hour later, though, on the river, Parker was stricken with a pang of recognition: he had seen that orange eye once before—on that June morning a year earlier. He was seized with grief at the thought he had possibly just held a new species in his hand and let it go—he might never see it again. At that point there was nothing to do. He was leading a tour and could hardly justify turning the boat around in the name of science. Besides, Dunning had probably released the bird by then.

A month later, back in Baton Rouge, Parker asked Dunning to send him the picture he'd taken of the bird at Yanamono. As soon as he had the photograph he began showing it to everyone at the museum. Angelo Capparella, a new Ph.D. candidate at that time, was heading for the Iquitos area in a few months, and Parker told him to keep an eye out for the bird and try to collect it if possible.


When Angelo returned at the end of the summer, Parker sought him out and asked about the flycatcher. Angelo confessed he'd forgotten all about the

bird and didn't remember seeing anything like it. Consequently, Parker didn't look at the specimens Angelo had brought back until a few days later, but when he did open up the specimen drawers he instinctively went to the flycatchers. The first *Tolmomyias* flycatcher he looked at had a "bright orange" eye, according to the data tag! The tag on the bird read:

"Shot in *varzea* undergrowth; N. bank Rio Amazonas, 85 km NE Iquitos; 30 July 1984; A.P. Capparella."

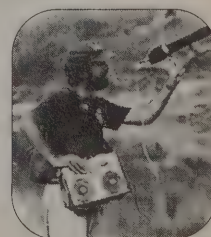
After "species" was a question mark in pencil. Angelo had shot the bird, taken a quick look at it, and mentally catalogued it as "one of those little flycatchers that all look alike."

"It's the only true *discovery* of a new bird that I know of," Van Remsen told me. "Ted's in a league all by himself. There's no one like him, no one who knows as much about neotropical birds." That's why, Remsen went on to explain, Parker may be the only ornithologist who has actually discovered a new bird in the wild rather than after the bird has been collected.

Discovery is the word I used many times when talking with the LSU people about the new species being found in Peru. Early on, O'Neill corrected me, pointing out that he had "described" several new birds, not really discovered them. First of all, in many cases local people were very familiar with the bird that the western scientists were all excited about, and *discovery* implies an immediate recognition of something new, which has been the case only a few times, and then only when the bird was "in the hand." But Parker knew enough when he first heard the new *Tolmomyias* flycatcher to realize it might be an undescribed species. 

Excerpted from *A Parrot Without a Name* by Don Stap. Copyright © 1990 by Don Stap.

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Ted Parker with famous Nagra.

PHOTO BY KEN ROSENBERG

PARA

Taxonomists

THE GLOBALLOCAL
SOLUTION:
local eyes —
quick to see,
at home,
and in love
with the land.



INBio

BY NANA NAISBITT

There is a sense of crisis in the taxonomic and natural history communities. With rapid species extinction, we don't have time—or fieldworkers or taxonomists—for the slow pursuit of taxonomy by academic specialists alone. Enter the parataxonomist.

The world's first "parataxonomists"—at least by name—are the Tico parataxonomists working at Asociación Instituto Nacional de Biodiversidad (INBio) in Costa Rica. The Tico "paras," who play roles parallel to paralegals or paramedics, are explicitly trained lay professionals. They find, collect, prepare, and label the specimens that they gather in or near the conservation areas that cover almost 25 percent of Costa Rica.

Taxonomists know that joining with paras is an essential shift. If a comprehensive species inventory is to be completed, it will require no-harm surveys and collection methods, and lots of patient people. Taxonomists can't even fathom doing it alone anymore. On a global scale, the parataxonomist model shifts natural history away from standing on the shoulders of academic specialists, giants in the field of taxonomy, to standing beside them. Today, INBio's parataxonomy program has become the model others look to replicate.

Parataxonomists do much of the same work as

their professional counterparts, except that they don't definitively identify or name new species or publish in professional journals. "Parataxonomists can do most of the field work, enabling the taxonomists to do what only they do best," says University of Connecticut professor of biology Robert Colwell, an INBio collaborator.

The testimonies of taxonomists about parataxonomists are so full of delight, it is as if the gods had smiled on their profession. Art Borkent, a research associate at the Royal British Columbia Museum and the American Museum of Natural History, and an INBio taxonomist teaching expert: "The group energy is incredible, they are like sponges, they can't get enough, and they are working long, hard hours well into the evening. Very high energy, a great pursuit. They're sucking up knowledge very quickly." Rob Roughley, coleopterist of pond and lake beetles, University of Manitoba, and INBio teaching expert: "They have a wonderful sense of humor—a very important element to a proud set of people—with an important sense of identity and duty. There's as much teaching of us by them as us teaching." INBio teaching specialist William Shepard, a coleopterist specializing in river beetles: "I found the 'paras' to be very eager to learn—so much so that I wish my Cal State students were as motivated. The

Barefoot parataxonomist in pursuit of butterflies.

collections made by paras that I have seen are excellent, and evidence keen eyes and an abundant knowledge of their own environments. I willingly count them as equal collecting partners in the field.”

Costa Rica’s forty parataxonomists are beginning to solve a long-standing problem: “the taxonomic impediment,” otherwise known as “the taxonomic bottleneck.” The fastidious process of finding, collecting, preparing, identifying, naming, labeling, describing, and publishing new species can get bogged down at any step. But the biggest bottleneck of all is this: Today’s taxonomists cannot pass on, to eager new students, the patient pursuit of taxonomy, because there are none. The best students are being lured into well-funded, high-tech, molecular taxonomy, leaving the job of collecting and naming new species underfilled, underfunded, under-respected, and fading into history.

THE HISTORICAL CONTINUUM

More than fifteen years ago a renegade ecologist named Dan Janzen, a professor of biology at the University of Pennsylvania, and a gentle plant virologist named Rodrigo Gamez recognized the bottleneck and devised a brilliant plan to systematically inventory all the species of a region called Guanacaste in Costa Rica. Gamez later expanded that vision to include the whole country. Their plan was to tap into an abundant underutilized resource—Costa Rica’s rural populace—by training locals as parataxonomists (minimum required education, grade school), laboratory technicians (high school), and local curators (B.A. in biology) to speed the collection and ID process. Local university professors and international taxonomists would insure accuracy and name new species according to international rules.

Gamez and Janzen followed in the footsteps (or stood on the shoulders) of two giants who together in 1879 began the largest biotic inventory attempted up to that time: Osbert Salvin, who was once so determined to collect water fowl on a lake in Dueñas, Guatemala, that he single-handedly built a boat out of green wood and ox hide, and Frederick Ducane Godman, who once poisoned nine miles of the Guatemalan Monyagua River with a local natural plant toxin to gather fish specimens with the help of locals. To aid their efforts in gathering samples of life in Central America, Salvin and Godman hired local collectors whom they trained, as well as international “expert collectors,” who sorted, identified, and named new species. Godman made special reference in the introduction to the sixty-three volume *Biologia Centrali-Americana* to Mateo Trujillo

(a parataxonomist before the name was coined) who assisted him as a “very skillful collector” the greater part of the time Godman was in Mexico. Their gargantuan effort ended in 1915. The project had lasted thirty-six years.

Seventy-five years later, Gamez/Janzen upped the Godman/Salvin ante by declaring an *all* tax inventory initiative in Costa Rica. They wanted to finish the job in this “megadiversity” nation with more than 500,000 species, of which only 18 percent have been described. They began by training parataxonomists.

Costa Rican parataxonomists, men and women, are recruited from communities adjacent to national conservation areas. They receive a six-month intensive course (costing about \$5,000 per parataxonomist) on the fundamentals of biology, taxonomy, evolution, ecology, collection, and preservation techniques, data management, and equipment maintenance techniques.



INBio

INBio personnel teach the courses, with support from national and international instructors. Their on-the-job training, together with informal discussions with the entire team, helps parataxonomists understand quickly why it is important to record, protect, and appropriately manage their biotic inventory.

Paras sort a day's prizes.

Once parataxonomists graduate, they work full-time near their homes, at biodiversity stations for which they are entirely responsible. INBio now operates twenty-eight such stations. Monthly, the parataxonomists turn in their collections to INBio’s research facility outside San Jose, where, working with INBio curators and visiting international taxonomists, they discuss and sort the gathered specimens. The paras’ salaries are equal to or slightly better than salaries for equivalent jobs. Paras are a lot more cost-effective than flying in students from other nations who work part-time and with greater financial burdens. The work is almost always an economic step up and, as important, an enriching

job that increases love of Costa Rica's natural heritage.

SEARCH IMAGE IN A DEPTH OF GREEN

Tropical rainforests are a deep screen of green, if you are not trained to see their parts. The most important skill a parataxonomist must acquire is a "search image." A search image is a flash of recognition, the ability to discriminate organisms instantly—whether in the shadowy movements of insects, the flight patterns or songs of birds, the architecture or smell of plants, or the telltale presence of a venomous snake.

Parataxonomy is not an office job, as Rob Roughley, the burly Canadian coleopterist once pointed out. Snakes, poison-arrow frogs, and bullet ants can be dangerous, and he often relies on the experienced parataxonomists. "They are our protectors, guides, companions and comrades in the field," he says. "I do not know what dangers I might have encountered without them."

Parataxonomist Alec Barrientos's search image is so good he can spot a spider in its web from a whip-lashing jeep ride. His skills help reduce redundant collecting. On a trip near the Rio Toro Amarillo shore, I watched as he caught sight of a digger bee on the sandy riverbank concentrating on making her nest. He knew that this particular bee species—with lacy wings that glint like an oil slick in the sun, elongated iridescent blue body banded in yellow, black eyes marked by a yellow spot between, white hairs bobbing on her black head—was already well represented in the collection at INBio and left her to her work. On this trip, he hoped to find new butterflies for INBio's collection (he col-

lected two). Alec has been at this job only a little over a year, but knows he has developed "more of an 'eye' for watching different plants and insects." He says he can see little things he never noticed before. Today, finely honed search images for microhabitats of tiny insects are the most highly praised skill of Tico paras.

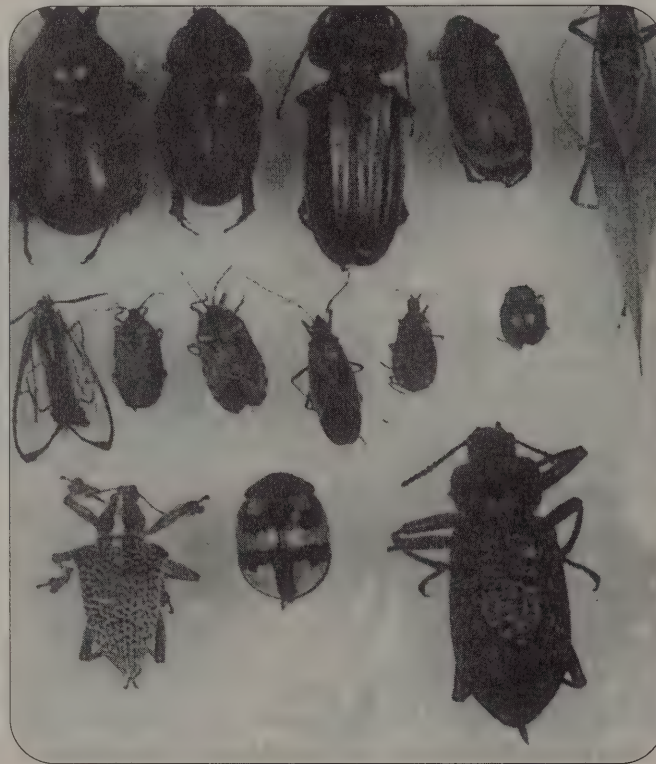
A COUNTRY OF TAXONOMISTS

A brilliant side effect of a rapid worldwide all species inventory initiative may be a localized, but global, grassroots conservation movement. "Using local people as parataxono-

"You don't have to teach parataxonomists that logging is bad. They know it!" says Don Rodrigo. "The living experience affects you profoundly. Through that experience you change your values and attitudes. I have seen that. Besides their technical and scientific contributions, it's the transformation of the individual that impresses me most." The parataxonomists, says Rodrigo Gamez "trigger the process by which INBio links the wildlands with society. The parataxonomists build personal and local pride. They know they are doing something for themselves, their communities, their country, and the world. And they take the message home to their villages."

This sense of transformation is echoed by the parataxonomists themselves. Married with three children, Socorro Avila Araya, has worked with the Mollusk Taxonomic Working Group (TWG) for five-and-a-half years. "I sacrifice a lot working here at INBio, because I am away from my family so much. But my work is very, very important because no one has done something like this before—a systematic inventory. This is the only way to know Costa Rica—to know its biodiversity. INBio is doing it right. My most important contribution is collecting and environmental education."

Parataxonomists are establishing a new ethic in Costa Rica, in part because of the nation's political stability, according to Alvaro Herrera, coordinator of INBio's collaborating taxonomists. "INBio is creating new tools for educating children and adults through INBio's educational park, through games, books, field guides, and the Internet. Teachers are using these tools. There are now environmental programs in all the schools.



TERRY L. ERWIN

mists," Art Borkent affirms, "empowers people to take care of their own land and preserve their own biota. Without that, it is basically ecological imperialism. As a population, Costa Ricans are very well educated about the value of their land. I heard it over and over again from everybody everywhere. They have a profound understanding about other life on the planet. In North America we are wholly ignorant. In the north, we recycle pop cans."

Collection of rainforest insects before taxonomic sorting.


Our protected areas belong to everyone. To the local communities—not the government. We are teaching responsibility for those protected areas.”

The INBio philosophy is teaching by doing. Bioliteracy programs have been established, and parataxonomists regularly speak at schools, universities, and communities. INBio’s programs aim at teaching people how to “read” and understand the power of nature for themselves. In other words, INBio is also honing the search image skills of average Costa Rican citizens. INBio is creating, in effect, a *country of parataxonomists*.

The INBio model is duplicable elsewhere in countries that are politically stable. Parataxonomist programs have already been successfully implemented in New Guinea and Guyana, benefiting from INBio’s experiment. As in Costa Rica, awareness of the value of undisturbed forests has begun to rise among local people in those two countries.

Today there is a loud echo in Costa Rica, New Guinea, and Guyana of the shared sense of purpose and spirit of discovery expressed in the *Biologia Centrali-Americana*. Taxonomists are anxious to join hands with parataxonomists to finish the massive inventory job, in the hope that the human world will appreciate species diversity, and care enough to preserve it. An all species inventory would rekindle an old fashioned sense of discovery among the world’s young, like explorers sailing to new lands, and arouse a global grassroots conservation ethic.

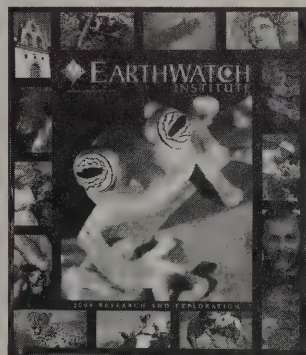
Given the parataxonomist paradigm, we can now cradle an iota of hope for slowing the mass extinction of the diverse natural expression of four billion years of evolution—but only if we create a *world of parataxon-*

omists led by a reinvigorated *core of taxonomists*. If not, our only connection to the natural world will be dead fish in jars, dead beetles in trays, and snuffed-out birds behind glass displays in museums. 

Nana Naisbitt, writer, artist, and naturalist, coauthored *High Tech High Touch* (Broadway Books, 1999). Nana recently traveled to the Costa Rican rainforests, INBio, the Smithsonian Institution, the Vienna Natural History Museum, and the California Academy of Sciences, researching her new book, *The Art of Evolution*. She is working to protect 880 acres of species-rich open lands near her hometown in Colorado, where she lives with her three children.

EARTHWATCH

3 Clock Tower Place, Suite 100, Box 75, Maynard, MA 01754 (see Web site for offices in UK, Australia, and Japan). 800/776-0188, 978/461-0081, info@earthwatch.org, www.earthwatch.org.



Earthwatch organizes citizens to join scientists in the field. You pay anywhere from about \$80 to \$200 per day for food, facilities, and the opportunity to do hands-on work with investigators for science projects. Earthwatch has about a half-dozen inventory projects that put into practice a great model for training “amateur” discoverers and describers of new species. These include finding rare plants in the Taita Hills of Kenya and katydids in Peru; and surveying distributions of birds in Tanzania and Australia, small carnivores in Argentina, and frogs in Ecuador. —PW

Tullgren funnels for separating small invertebrates from soil and leaf litter.



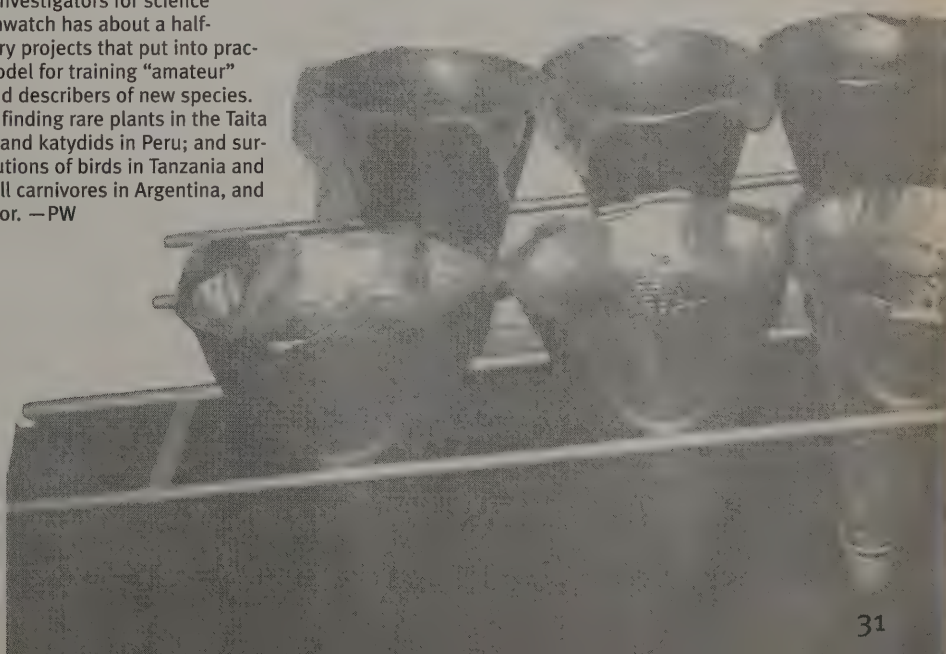
INBIO

Lab technician sorting insects at INBio.

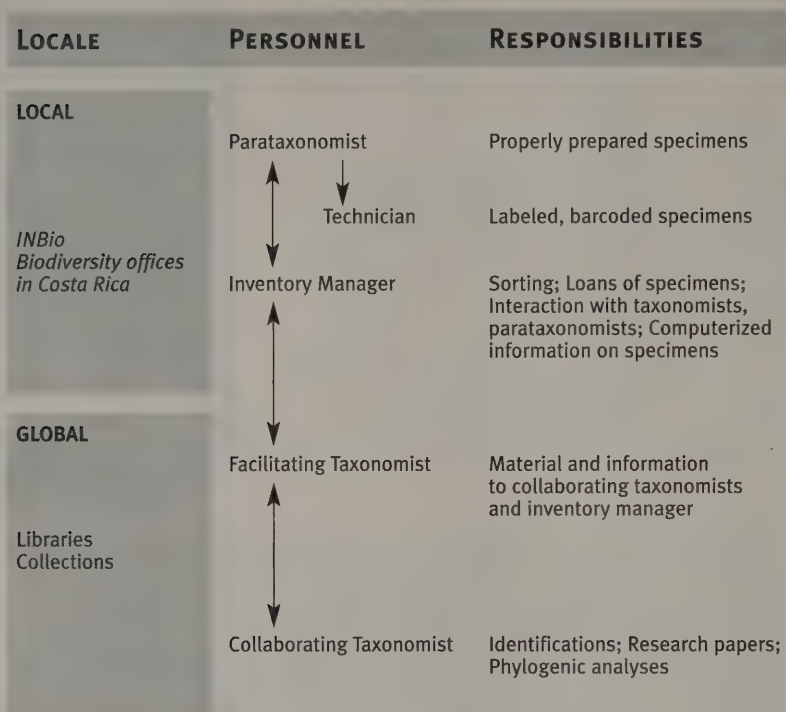
BRIDGE OF THE GODS • DRAGONFLY STUDY

Oregon Field Guide Episode 1105 (video) Steve Amen, host. 1999; 30 mins., \$25 post-paid. Audience Services, Oregon Public Broadcasting (OPB), 7140 SW Macadam Avenue, Portland, OR 97219. 800/293-1982, 503/293-5813, www.opb.org.

The “Dragonfly Study” segment of this program from OPB’s Oregon Field Guide series is an inspiring affirmation for all enthusiastic amateurs. You really don’t have to be Linnaeus. The fifteen-minute segment looks at the influence of two men (with limited scientific knowledge, but a deep love for dragonflies) as they record and classify the insects. It’s surprising to learn that one of the world’s oldest insects still remains among the least researched; photographs have not been taken of all species. The video makes you want to pick up your magnifying glass and catching net and get out to the swamps! —EP



GLOBALLOCAL CONNECTIONS: From Para to Specialist



Asociación Instituto Nacional de Biodiversidad (INBio)

Created in 1989, INBio is a not-for-profit, private scientific institution with a social orientation. With a central research facility near San José and twenty-eight research stations and offices in major conservation areas of Costa Rica, INBio employs about 165 Costa Ricans. INBio began as an institution dedicated to non-destructive uses of species by society. The inventory program is just one part of its mission. Other programs now include sustainable uses of species, especially commercial uses discovered by bioprospecting; the organization and administration of biodiversity information; and the transfer and dissemination of biodiversity knowledge to the public and private sectors.

The annual operations cost of the parataxonomist program (forty paras) totals around \$800,000, out of an annual budget for inventory of close to \$2.2 million. Most of the inventories to date have been of plants and animals, but have expanded to other groups in the last few years. A major education effort

includes more than 14,000 Web pages, each describing a Costa Rican species. More than ninety paras have passed through the training program.

INBio receives 79 percent of its funds from multilaterals (World Bank) and government agencies (Norway's NORAD; Swedish SIDA; Spain's AECL; the Dutch, Canadian, and Spanish governments, and others). Research agreements with private firms for bioprospecting account for 8 percent of the budget. In addition to the bioprospecting funds, INBio receives technology, training, and royalties from net profits if a research product is successfully commercialized. The rest of its income comes from the Costa Rican government.

INBio signed the first benefit-sharing agreement between a drug discovery company and an institution in a biodiversity-rich nation (\$2.6 million from Merck in 1991). It also signed the first agreement for gene prospecting, with Diversa of San Diego. With Diversa, it helped create the model for the

Yellowstone bioprospecting for thermal pool microbes. In ten years of bioprospecting, INBio has signed sixteen commercial and non-commercial prospecting agreements, including those with Bristol-Myers Squibb (1993); the Swiss/US company Givaudane Roure (for fragrances, 1994); the Italian manufacturer INDENA (for phytomedicines, 1996); the German company Analyticon (1996); the Costa Rican company LaPacifica; the British Technology Group (for an anti-nematode pesticide from a tropical legume, 1994); and the US-biotech company Phytera (for the development of cell cultures for plants).

As of 1998, INBio's bioprospecting agreements had contributed more than \$390,000 to the Ministry on the Environment and Resources; \$710,000 each to universities and conservation areas; and \$740,000 to other groups at INBio, particularly the inventory program. —PW

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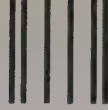
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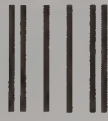
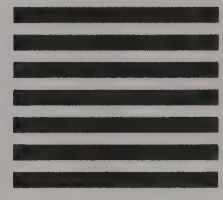


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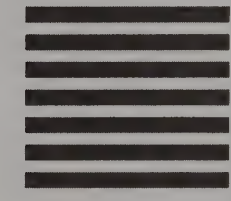


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A BIRD FLEA NEW TO *Britain*

BY MIRIAM ROTHSCHILD

Systematists are naturalists born, not made. From the age of five, when I asked my father why some ladybirds had more spots than other ladybirds, I was enthralled by the small differences in the inhabitants of the natural world. This still excites my interest, whether it concerns a bunch of bristles on the backside of a flea, the infinitely graceful sweep of a larval trematode worm's improbable tail, or the difference between the songs of a robin and a nightingale.

When I began to take lessons in zoology, I added ambition to wonder, and dreamed of achieving fame, if not fortune, by the discovery of a species new to science. I would have not only the pleasure of announcing a great find, but the secret joy of having a creature known only to myself. The species would have existed on Earth for ten thousand years or more, without anyone realizing its presence before, and I would have infinite pleasure in demonstrating the subtle differences between it and its nearest relatives that make it unique.

When I grew up, I found there are many ways of finding species new to science, or new to the country where you live, not only by assiduous collecting in the countryside, but by careful observation and comparison of related specimens preserved in many collections or in written descriptions in books and journals.

One day I was lying in a hospital bed recovering from major surgery and trying to find a comfortable position in which I could read. I was fretfully turning over pages of a natural history journal, and feeling rather sorry for myself, when the record of fleas from the nest of a Carrion crow suddenly caught my eye. The author had apparently incorporated two specimens in his collection, one of which he described as an abnormal variety of the hen flea (*Ceratophylus gallinae*), a species that has a wide distribution and is found in numbers in the nests of a great many different birds. In a flash I felt certain this so-called "abnormal" hen flea was in reality a specimen of the relatively rare continental Carrion crow flea, (*C. rossitensis*), which is only found in their nests, never in those of other birds. So far, it had not been collected anywhere in Britain. It had been thirty-seven years—before I was born—since a bird flea new to Britain had been recorded. What a find if it

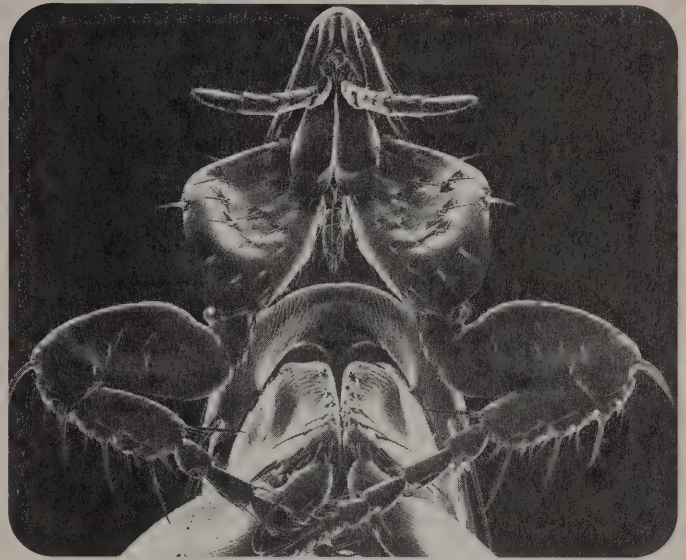


PHOTO BY DAVID SCHARF, FROM *MAGNIFICATIONS*, 1977 (OUT OF PRINT).

was true! I was so excited by this intuitive conviction that I exclaimed aloud "It's *rossitensis*!" A watchful nurse immediately came to my bedside and asked if I felt all right. When I explained I had found a flea new to the UK, she insisted, despite my vigorous protestations, on taking my temperature.

I lay back in bed and envisaged the two species. I could remember just that they could only be distinguished by differences in the shape of the clasping organs of the male and the shape of the spiracle of tergum seven in the female. But there were probably many other subtle distinctions. In rat fleas one could only discern small external differences between the species that spread the bacteria responsible for the plague and those fleas which did not. That is why systematics is so important in studying disease.... I began to wonder WHY *Ceratophylus rossitensis*, which is so similar to the hen flea, is rare and confined to crows, while the hen flea is so common, with numerous different avian hosts. The fact is, systematics opens so many unexpected doors....

Someone once asked me to define my so-called scientific activities. "Well," I said without hesitation, "I've spent fifty years debunking my brilliant flashes of instinct!" But in the case of the Carrion crow flea, my instinct provided a good guess.

The Honorable Miriam Rothschild is my ideal zoologist, with affections for fleas, butterflies, moths, flies, intestinal worms, marine snails, mites, and bigger creatures. She works to protect hayfields, hedgerows, streams, dew ponds, and their wildlife. A great writer. Try *Fleas, Flukes and Cuckoos: A Study of Bird Parasites* (out of print) for a wry start.

Above: Not a bird flea. The underbelly of the common dog flea (Family Pulicidae) magnified 222x by scanning electron microscope.

TAKE ME, LORD, TO AN UNEXPLORED PLANET TEEMING WITH *New Life Forms*....



by E. O. Wilson

At Mina Carlota we found ourselves at last in the midst of an abundance of the old fauna and flora of the Cuban mountains. Forty years earlier, William Mann, then a Harvard graduate student studying ants and now, in 1953, director of the National Zoo, had traveled to this exact spot. After a few hours of random collecting, he stumbled upon a new species of ants, which he later named *Macromischa wheeleri* in honor of his sponsoring professor, William Morton Wheeler. In 1934 he recounted his discovery thus in the *National Geographic*:

I remember one Christmas Day at the Mina Carlota, in the Sierra de Trinidad of Cuba. When I attempted to turn over a large rock to see what was living underneath, the rock split in the middle, and there, in the very center, was a half teaspoon of brilliant green metallic ants glistening in the sunshine. They proved to be an unknown species.

Ever since reading that passage as a ten-year-old, I had been enchanted by the idea of prospecting in a faraway place for ants that resembled living emeralds. Now here I was at the very same place, climbing the steep forested hillside of Mina Carlota. Searching for ants, I turned over one limestone rock after another, perhaps a few of the very ones that Mann had handled. Some cracked; some crumbled; most stayed intact. Then one rock broke in half, exposing a cavity from which poured a teaspoonful of the beautiful metallescent *Macromischa wheeleri*. I took a special satisfaction in repeating Mann's discovery in exact detail after such a long interval of time. It was a reassurance of the continuity of both the natural world and the human mind....

Mount Mou, New Caledonia, December, 1954....

Not just the ants but everything I saw, every species of plant and animal, was new to me. These

creatures were a fully alien biota, and it is time to confess: I am a neophile, an inordinate lover of the new, of diversity for its own sake. In such a place everything is a surprise, and I could make a discovery of scientific value any time I wished. My archetypal dream came clear:

Take me, Lord, to an unexplored planet teeming with new life forms. Put me at the edge of virgin swampland dotted with hummocks of high ground, let me saunter at my own pace across it and up the nearest mountain ridge, in due course to cross over to the far slope in search of more distant swamps, grasslands, and ranges. Let me be the Carolus Linnaeus of this world, bearing no more than specimen boxes, botanical canister, hand lens, notebooks, but allowed not years but centuries of time. And should I somehow tire of the land, let me embark on the sea in search of new islands and archipelagoes. Let me go alone, at least for a while, and I will report to You and loved ones at intervals and I will publish reports on my discoveries for colleagues. For if it was You who gave me this spirit, then devise the appropriate reward for its virtuous use....

Esperance to Mount Ragged, Western Australia, January-February, 1955....

The next day our thoughts turned entirely to *Nothomyrmecia macrops*. The idea of the "missing link" ant is about as romantic a concept as is possible for an entomologist. The whole story began on December 7, 1931 when a holiday party set out by truck and horseback from Balladonia, a sheep ranch and beer stop on the cross-Australia highway north-east of Esperance. They traveled leisurely for 175 kilometers southward across the vast, uninhabited eucalyptus scrub forest and sandplain heath. In this first leg they passed close to Mount Ragged, a forbidding treeless granitic hill. Then they stopped for a few days at the abandoned Thomas River station on the coast before turning west to Esperance, where they took rail and automobile transportation back home. The habitat they traversed is botanically one of the richest in the world, harboring large numbers of shrubs and herbaceous plants found nowhere else. A naturalist and artist resident at Balladonia, Mrs. A.E. Crocker, had asked members



If naturalists are born, this book proves it. No other autobiography is so well paced and precise and passionate.
—PW

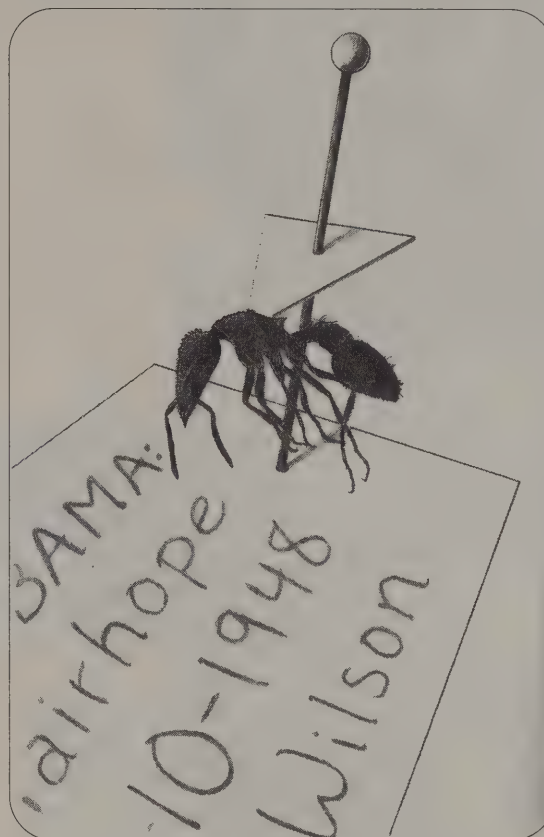
of the party to collect insects along the way. These they placed in jars of alcohol tied to the saddles of their horses. The specimens, including two large, oddly shaped yellow ants, were turned over to the National Museum of Victoria in Melbourne. There the entomologist John Clark described the ants in 1934 as a new genus and species, *Nothomyrmecia macrops*.

Our hopes were high as we left Esperance the next day, retracing the 1931 party's route in reverse. We were accompanied by the Australian naturalist Vincent Serventy and Bob Douglas, an Esperance native who served as camp manager and cook. We rode on the flatbed of a huge hand-cranked truck that had seen service on the Burma Road during the war. On the nearly invisible rutted dirt road to the Thomas River farm, we encountered not a single person. The sun bore down from the blue summer sky, from which bush flies descended in relentless swarms. When we stopped the only sound we heard was the wind whispering through sandheath shrubs.

We found the Thomas River to be a dry bed—an arroyo—in a basin depressed twenty-five to thirty meters below the level of the sandplain. Its floor had once been shaded by tall yate trees and carpeted by grass. Not long after their arrival in the 1890s, the first settlers had thinned the yate forest, and their flocks of sheep had destroyed the grass. Now, a half-century later, the groves were composed of a mix of yate, paperback, and wattle, and the forage had been replaced by patches of succulent salt-tolerant herbs. Huge nests of meat ants, five to ten meters across and seething with hundreds of thousands of big red-and-black workers, dominated the more disturbed swaths of open terrain.


Nothomyrmecia could have been anywhere in such a varied environment. I was excited and tense, knowing that we might find scientific gold with a single glance to the ground. Haskins and I set to work immediately, each hoping to be the lucky discoverer. We searched back and forth through the basin grove, turning logs, scanning the tree trunks, inspecting every moving light-colored ant remotely resembling a *Nothomyrmecia*, but found nothing. We hiked up onto the sandplain, and this time lost our way. Rather than risk wandering farther from camp in a dangerous desert-like environment, we settled down to wait for daybreak. To my surprise, Caryl found a football-sized rock, pulled and rocked it as though positioning a pillow, lay on his back on the ground, and fell asleep. I was too keyed up to attempt the same feat and spent the rest of the night searching for the ant in the immediate vicinity. How marvelous it would be, I thought, if I could hand Caryl a specimen when he awoke!...

Research progress was rapid and satisfying around the Thomas River, at least by ordinary standards of field biology. We discovered new species, in the course of which we also defined an entire ecological guild of sandplain ants specialized for foraging on the low vegetation at night. Large-eyed and light-colored, they represent members of the genera *Camponotus*, *Colobostruma*, and *Iridomyrmex* that have evidently converged in evolution to fill this arid

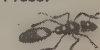


©1994 BY LAURA SIMONDS SOUTHWORTH

niche. Because *Nothomyrmecia* is also large-eyed and pale, we reasoned that it was a member of the guild, and so we concentrated our efforts on the sandplain.

We never found *Nothomyrmecia*, but we made it famous. In the years to follow, other teams of Americans and Australians scoured the area with equal lack of success. The ant acquired a near-legendary status in natural history circles. The break finally came in 1977 when Robert Taylor, a former Ph.D. student of mine at Harvard and at that time chief curator of the Australian National Insect Collection, stumbled upon *Nothomyrmecia* in eucalyptus scrub forest near the little town of Poochera, in South Australia, a full thousand miles east of the Thomas River. It was a totally unanticipated discovery. Taylor came running into camp shouting (his exact words) in pure Australianese, "The bloody bastard's here! I've got the *Notho-bloody-myrmecia!*" 

Excerpted from *Naturalist* (Edward O. Wilson. 1994; 380 pp. \$24.95. Island Press/Shearwater Books). Reprinted with permission of Island Press.



NABOKOV'S *Butterflies*



FROM NABOKOV'S BUTTERFLIES

“ Entomologists are the most gentle people on earth—until a taxonomic problem crops up; it then transforms them into tigers. —FROM A LETTER TO MICHAEL WALTON, 1971

“ Near the intersection of two carriage roads (one, well-kept, running north-south in between our “old” and “new” parks, and the other, muddy and rutty, leading, if you turned west, to Batovo) at a spot where aspens crowded on both sides of a dip, I would be sure to find in the third week of June great blue-black nymphalids striped with pure white, gliding and wheeling low above the rich clay which matched the tint of their undersides when they settled and closed their wings. Those were the dung-loving males of what the old Aurelians used to call the Poplar Admirable, or, more exactly, they belonged to its Bucovinian subspecies. As a boy of nine, not knowing that race, I noticed how much our North Russian specimens differed from the Central European form figured in Hofmann, and rashly wrote to Kuznetsov, one of the greatest Russian, or indeed world, lepidopterists of all time, naming my new subspecies “*Limenitis populi rossica*.” A long month later he returned my description and aquarelle of “*rossica* Nabokov” with only two words scribbled on the back of my letter; “*bucovinensis* Hormuzaki.” How I hated Hormuzaki! And how hurt I was when in one of Kuznetsov’s later papers I found a gruff reference to “schoolboys who keep naming minute varieties of the Poplar Nymph!” Undaunted, however, by the *populi* flop, I “discov-

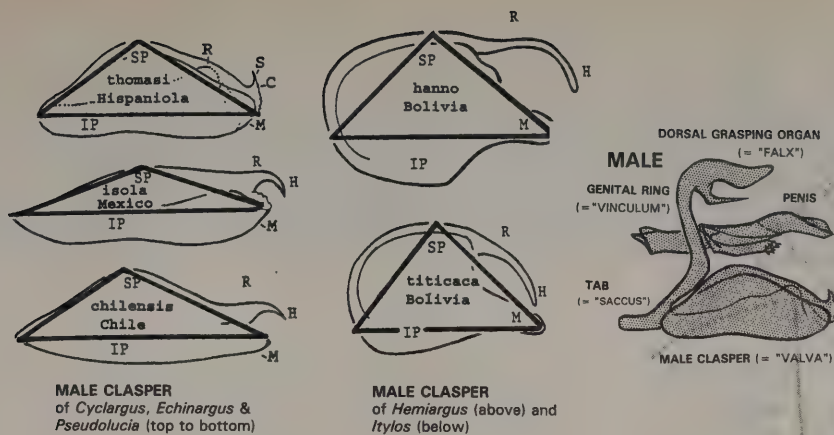
ered” the following year a “new” moth. That summer I had been collecting assiduously on moonless nights, in a glade of the park, by spreading a bed-sheet over the grass and its annoyed glow-worms, and casting upon it the light of an acetylene lamp (which, six years later, was to shine on Tamara). Into that arena of radiance, moths would come drifting out of the solid blackness around me, and it was in that manner, upon that magic sheet, that I took a beautiful *Plusia* (now *Phytometra*) which, as I saw at once, differed from its closest ally by its mauve-and-maroon (instead of golden-brown) forewings, and narrower bractea mark and was not recognizably figured in any of my books. I sent its description and picture to Richard South, for publication in *The Entomologist*. He did not know it either, but with the utmost kindness checked it in the British Museum collection—and found it had been described long ago as *Plusia excelsa* by Kretschmar. I received the sad news, which was most sympathetically worded (“...should be congratulated for obtaining...very rare Volgan thing... admirable figure...”) with the utmost stoicism; but many years later, by a pretty fluke (I know I should not point out these plums to people), I got even with the first discoverer of my moth by giving his own name to a blind man in a novel. —FROM NABOKOV’S AUTOBIOGRAPHY, *SPEAK, MEMORY*

Below: A series of Boisduval's Blue collected by Nabokov in Arizona in 1956.

FROM NABOKOV'S BUTTERFLIES



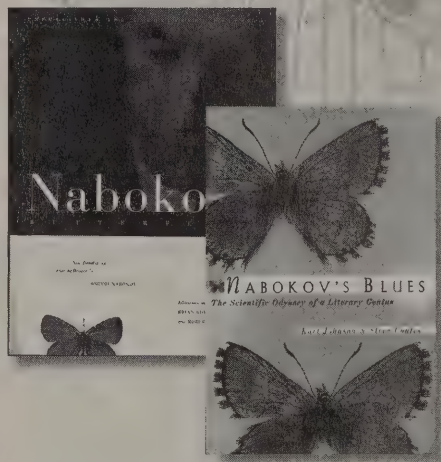
All selections are from NABOKOV'S BUTTERFLIES (facing page).



Above: Nabokov's much-admired innovation, the superimposition of "magic triangles" over his drawings of butterfly genitalia, allowed him to map the ground plan of species within genera. From Nabokov's *Blues*.

“ Q: You have been quoted as saying: My pleasures are the most intense known to man: butterfly hunting and writing. Are they in any way comparable?

A: No, they belong essentially to quite different types of enjoyment. Neither is easy to describe to a person who has not experienced it, and each is so obvious to the one who has that a description would sound crude and redundant. In the case of butterfly hunting I think I can distinguish four main elements. First, the hope of capturing—or the actual capturing—of the first specimen of a species unknown to science: this is the dream at the back of every lepidopterist's mind, whether he be climbing a mountain in New Guinea or crossing a bog in Maine. Secondly, there is the capture of a rare or very local butterfly—things you have gloated over in books, in obscure scientific reviews, on the splendid plates of famous works, and that you now see on the wing, in their natural surroundings, among plants and minerals that acquire mysterious magic through the intimate association with the rarities they produce and support, so that a given landscape lives twice: as a delightful wilderness in its own right and as the haunt of a certain butterfly or moth. Thirdly, there is the naturalist's interest in disentangling the life histories of little-known insects, in learning about their habits and structure, and in determining their position in the scheme of classification—a scheme which can be sometimes pleasurably exploded in a dazzling display of polemical fireworks when a new discovery upsets the old scheme and confounds its obtuse champions. And fourthly, one should not ignore the element of sport, of luck, of brisk motion and robust achievement, of an ardent and arduous quest ending in the silky triangle of a folded butterfly lying on the palm of one's hand. —FROM AN INTERVIEW WITH ALVIN TOFFLER, PUBLISHED IN *PLAYBOY*



Above: Nabokov worked out an elegant cross-row system for mapping individual markings. From Nabokov's *Butterflies*.

NABOKOV'S BUTTERFLIES

Unpublished and Uncollected Writings

Brian Boyd and Robert Michael Pyle, eds. (new translations by Dmitri Nabokov). 2000; 782 pp. \$45. Beacon Press.

NABOKOV'S BLUES

The Scientific Odyssey of a Literary Genius

Kurt Johnson and Steve Coates. 1999; 372 pp. \$27. Zoland Books.

Many readers of Vladimir Nabokov's fiction are unaware of his achievements as a naturalist, or think of him as a great writer who dabbled in butterflies. In fact, the author of *Lolita* and *Pale Fire* was an accomplished, passionate (and third-generation) lepidopterist. His work while a research fellow at the Harvard Museum of Comparative Anatomy transformed the taxonomy of the Blue butterflies of the Neotropics—he named seven new genera and restricted two others—and anticipated formulations to come fifty years later. *Nabokov's Butterflies* nets virtually every extant Nabokovian reference to moths and butterflies, from letters to friends to scientific papers to poetry and novels. *Blues* is a great companion volume, putting the writings into context and tracing their significance. —MKS

Describe

Toward a Revival of Bio-Portraiture



This mini-section focuses on describing life-forms in order to name them by today's scientific standards. The art of description, like any craft, relies on tools (page 40), analytic powers (page 45), the rules handed down by history (in this case the rules of nomenclature, page 47). Luckily this dry and serious business also includes moments of whimsy, such as choosing new species names (pages 42 and 46).

Description starts when the eye hones in on detail, distinctions, and bio-portraiture of the discovered life-form. There's no exact moment when discovery changes to description. When my friends, striding quickly past a city pigeon, say "trash bird," they are doing it all: scouting, spotting, mentally imaging, sorting images, categorizing, and proclaiming a favored folk phrase for our too-familiar feathered friend. (They could have uttered the more official Rock Dove, more polite Domestic Pigeon, or Linnean *Columbia livia*).

Linnean classification, the framework for the all species inventory, rejects casual categories like "trash bird." It insists on a strict, unique system for encoding life-forms: race or subspecies, species, genus, family, order, class, phylum, kingdom, and domain. The job of the systematist (describer) is to figure out where a life-form fits into this scheme, usually as a species between the subspecies and genus. The thought process is hierarchical, rigid, and logical. "X is a kind of Y because....It is subordinated within the genus category because....It is above the subspecific or race category because...." Once the describer is sure it's a good fit, the species gets a name (page 47).

When my friends say "trash bird," they employ a very different mode to describe the natural world: "X is like Y." Our poor pigeon is common and discardable, like garbage. Linneaus was proud to put this loose terminology behind him. He was reacting to the wild similies of 1600s bestiaries with their giddy enthusiasm for multiple names for different contexts. Here's the "Sagoin" (probably a marmoset) from Topsell's famous bestiary (page 56): "Somewhat

ash-coloured, a tail like a Rat, but hairy; the feet of a Squirrel, and the face almost like a Martine, or Satyre, a round ear, but very short and open, and in other conditions like a Munkey. They are much set by among women, it being very probable that they are conceived by a small ape and Weasell, for in that Country, by reason of the heat thereof, there are many such unnatural commixtions."

For birders, this loose complexity happens naturally, without the cognitive and intellectual intensity heard in the world of taxonomists. One day, talking to an older birder, you see a bird and say "White-tailed kite" and then turn to a younger birder and say "Black-shouldered kite" (recognizing that she probably knows only the newer common name). In a California foothills bar, a local is happy to hear that you saw "angel hawks" (a beautiful folk name, founded on the kite's hovering like an angel). The ornithologist on the next stool wants to make sure and details the differences between *Elanus caeruleus* (the Black-shouldered kite) from *Ictinia mississippiensis* (the Mississippi kite).

This digression has a point. The two approaches—hierarchical vs. loose complexity with many contextual names—have swung in and out of favor, though no one knows exactly how or why. Linnean hierarchical classification and "classic" species definitions have entered shaky times with the advent of new information from molecular biology and the taxonomic school of "cladists." Both, in different ways, have new ways to describe life-forms. They modify or discard aspects of Linnean detailing, distinctions between features, and portraiture. Many molecular biologists and cladists have little concern for the domain-to-species system. The all species researchers need not panic, but should take heed of this wildcard, lest they discover that they no longer know what a "species" is (page 43).

More bio-portrait artists, please

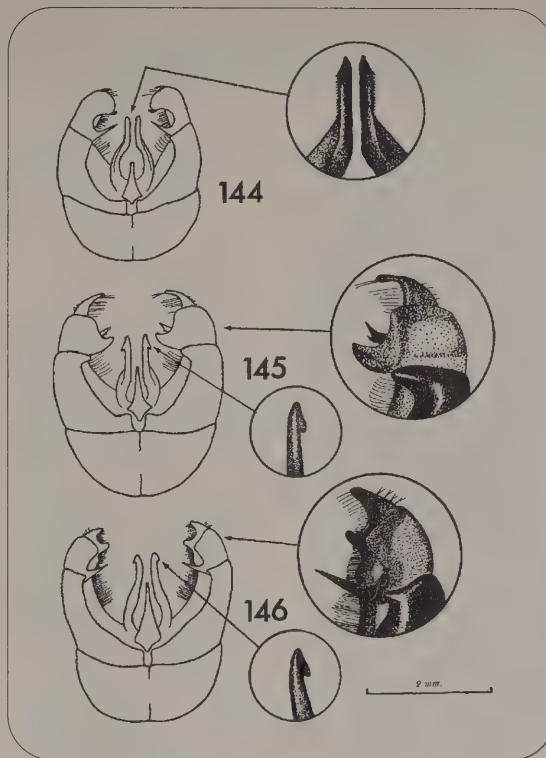
No matter how species are described, the upshot of the recent decades is that there are fewer and fewer describers who know and practice the art/science. Many "pragmatic" taxonomists have turned toward molecular biology in order to seek commer-

cially profitable species to patent (page 49). They are abandoning the natural history ship for the lab. Many heartfelt naturalists search out work, get paid peanuts, and abandon the profession when they need more secure incomes. Natural history carries a rep as antique science, quaint.

Maybe 20,000 to 30,000 systematists (taxonomists) practice worldwide. The number involved in describing new species is estimated at 7,000. Most live in Europe or North America (only 6 percent of all biologists live in the nations with 80 percent of the planet's species). These taxonomists are an aging lot. Even among the 7,000, the majority do not spend full-time sorting and describing. A typical guesstimate is that they spend 20 percent of their time doing taxonomy. If that's accurate, then only the equivalent of 1,400 (.2 x 7,000) full-time taxonomists now roam the planet.

The decline of taxonomy is reflected in the rate of description of new species, which has remained constant for twenty-five years. Even if only 15 million species remain undescribed (rather than the 30 million or 90 million that some estimate), it would take 575 years, at the current rate, to describe them.

Besides being too few, taxonomists are mismatched with the diversity of life. Too many bird peo-

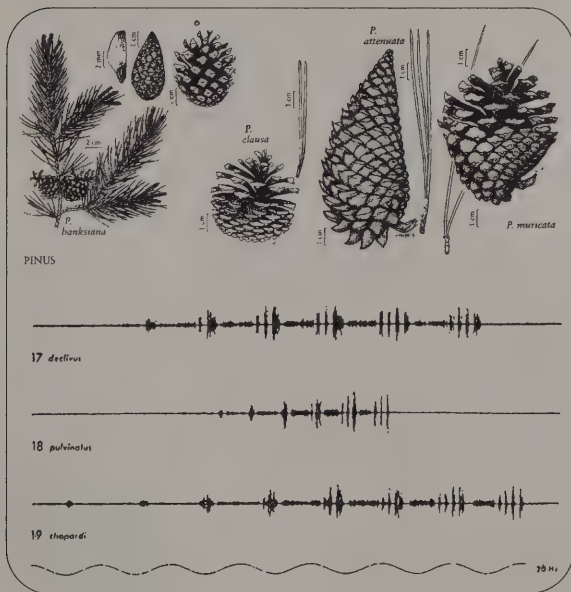


Microscopic description, by hand drawings, of the genitals of bumble bees (*Bombus*).

ple, too few interested in diatoms and nematodes. For every 100 vertebrate taxonomists, there are only ten involved with plants, and one with insects. Finding enthusiastic young people with an interest in becoming taxonomists is actually not so hard (lots of youngards love to collect and sort and think about life-forms). The major stumbling blocks are funding, insufficient facilities to educate taxonomists or train apprentices, and a general malaise—an assumption that the classification job is essentially done.

Indifference, funding shortages, and no prospects for immediate payoff are familiar conditions to artists. Perhaps the all species project, a mythical and lyrical calling, is more like artistic pursuits in its dream of elegantly depicting all the species. The energy behind the inventory will falter if it's envisioned only pragmatically, without an artist's heart-felt flare. But if the inventory can provide the occasion to bring new passion to bio-portraiture, it may offer the best hope of reviving the fading arts and sciences of natural history and taxonomy. —PW

Left top: Hand lens and eye-balled descriptions of the major features of pines (*Pinus*). Bottom: Auditory descriptions of the songs of grasshoppers (*Enorthrippus*) by an oscilloscope.



PIMPRNA	CCATCACGGGGTGT-GCACCTG--GTCTCTGC-GT-CCATCCTCGGGGAGA
PBUTRNA	CCATCACGGGGTGT-GCACCTG--GCTTC'GC-AG-CCATCCTCGGGGAGA
PVESV04	TTCATTAANAATACTTCCATTATTTTTATTATATCATCATCGAAAAGA
PFORRNA	CCATCACGGGGTGT-GCACCTG--GTCTCTGC-GT-CCATCCTCGGGGAGA
	*** * * * * * * * * * * *
PIMPRNA	CGCGGTCTGG--CATTCAGTTGTCCGGCCGGGATCCCTCGTCAATTTACTG
PBUTRNA	CGCGGTCTGG--CGTTAAITCGTCCGGCCGGGATCCGGCTCAATTTACTG
PVESV04	TTATATTTTGGTCATPCATTTGTCTAGTATAAAGATTTTCGTCATTTACTG
PFORRNA	GCATGCCCTCG--CATTCAGTTGTCCGGCTATGGGATCCCTCGTCAATTTACTG
	* * * * * * * * * * * * * * * * * *

DNA sequences for flagellates from the hypervariable regions of the 18S ribosome (*Paraphysomonas* sp.).

ILLUSTRATIONS FROM GLOBAL BIODIVERSITY ASSESSMENT (PAGE 10).

TOOLS AND ALL SPECIES

As time goes by, we scrutinize smaller and smaller parts of our bodies, and smaller and smaller niches of the planet. Nothing escapes our insatiable curiosity. Once we only knew river fish, caught with bare hands; then spears, and dip and seine nets; now deep-sea fishing fleet boats and floats, radar and gill nets. Fish biologists descend in bathyspheres and submarines to the deepest oceanic canyon, and trawlers scrape up odd saltwater nematodes and mollusks from the bottom sediments. We live in an era when no part of the biosphere remains uninfluenced by the human saga of discovery and exploration. And the story hinges on new tools.

Tools are additive in natural history. They rarely replace one another. Insect lovers, for instance, also began bare-handed. Then they added the butterfly net, and the aspirator for tiny insects that might slip through the net. Then traps such as ultraviolet lights, zappers, and sticky-paper to find new kinds of insects. Now foggers with insecticide to see who lives in the forest canopy on the farthest inaccessible twigs. But quick hands and eyes still count.

Equipment has improved the "eyesight" of natural history buffs by ten orders of magnitude, hastening new species discoveries, forcing new vocabularies and descriptions: microscopic metazoans, single-cell procaryotes, viruses; and, in taxonomy, bodyscape parts invisible to the unaided eye: chromosomes, organelles, stomata, nuclei. After light microscopes came scanning and transmission electron microscopes and microvideo. Dead dirt became living soil; pure water became living water. "An" insect became a bodyscape with mites in its spiracles and a metropolis of unicellular life-forms inhabiting its gut.

The latest surges come from three techno-innovations: electronic and digital technology; satellite transmitters (see GPS); and molecular biology.

I'm a conservative outdoorsman and didn't quite catch on to the digital and molecular influences until the mid-1980s. In the midst of an acrimonious controversy about the endangered population of the Mt. Graham red squirrel, the University of Arizona (which desired to cut many of the squirrel's trees to make room for new telescopes) questioned the taxonomic status of the squirrel. Was it really different from other related populations? And if not, could it be taken off the endangered species list? We all picked up run-over squirrels, and squirrels stored in refrigerators, and sent them to a lab to be sorted by allozymes (essentially enzyme proteins). We field biologists, now with a great affection for this six ounces of scampering rodent, shivered a bit in anticipation. Analyzers mixed squirrel proteins into a gel. They watched embedded proteins migrate at different speeds depending on their weight and charge (see electrophoresis illustration, left). They compared the patterns formed by protein migrations. The molecular "fingerprint" would show the similarities or differences. The Mt. Graham red squirrel was demonstrated to be the most different population of all the squirrels tested, and the University dropped the argument.

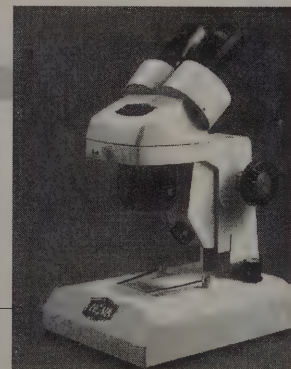
Allozyme electrophoresis, as the process is called, is now the "ancient technique" of molecular biology. In the 1990s, a group of proteinaceous acronyms for new techniques—PCR, RFLPs, RAPDs and DNA/RNA sequencing (see box, page 41)—were added. They joined allozymes in giving taxonomists

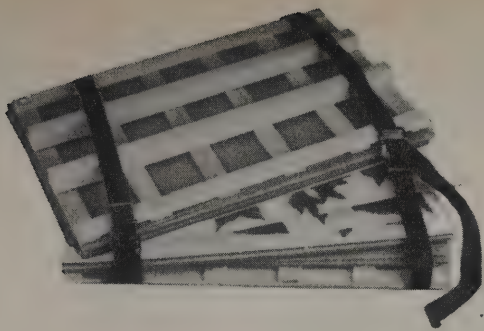
In electrophoresis, molecules separate out by both size and electrical charge. Smaller molecules move faster in the gel than larger. The above shows separated DNA fragments.

TOOLS AND TININESS

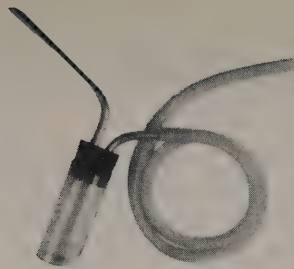
Optical Equipment	Naked eye	Hand lens; stereo-microscope	Light microscope	Scanning electron microscope	Transmission electron microscope
Size of Subject in Meters	$10^{-3} - 10^2$	$10^{-4} - 10^{-2}$	$10^{-6} - 10^{-4}$	$10^{-8} - 10^{-2}$	$10^{-9} - 10^{-5}$

Stereo microscopes (right) show botanical and insect details barely visible to the human eye. Light microscopes add detail on cell structures, electron microscopes add more surface details, transmission microscopes add interior cell structures.





Left: The classic plant press.
Right: An insect aspirator for insects too small to be netted or picked up with forceps.



new features to view the variety between individual creatures and whole populations. Using "molecular probes," they have discovered new species of single-celled organisms that have never been seen. (To "see" a bacteria, you must culture it in a pure medium and isolate it from similar kinds. But many single-celled organisms have so far been "unculturable," known only by DNA pieces found in soil and water.)

Molecular biology is pricier than sorting by arthropod genitals, spider

eyes, hair tufts, and feathers, but many taxonomists like the hi-tech lab and the avant-garde glory. Molecular analysis is their new toy. Since, to be a species, you currently have to breed successfully with others of your ilk (and DNA cannot predict who will get it on and who will not), molecular biology is not the "solution" to taxonomy. But an all species inventory must now collect DNA/RNA samples as part of its quest. New bottles and preservatives definitely fill a collector's backpack pocket. —PW

MOLECULAR TECHNIQUES TO DESCRIBE SPECIES

- PCR: Polymerase Chain Reaction helps amplify the amount of DNA for easier detection. It is not directly involved in description.
- RAPD (Random Amplified Polymorphic DNA) characterizes a species by mismatches and matches between one protein (the primer) and the DNA template. It requires PCR to amplify the amount of DNA.
- RFLP (Restriction Fragment Length Polymorphism) helps characterize both maternal DNA found in organelles like mitochondria and chloroplasts, and nuclear DNA for Mendelian inheritance. It's used with other techniques such as probes, staining, and electrophoresis.
- DNA "fingerprinting" for both maternal and Mendelian inheritance is a technique to find high numbers of loci that vary a lot and compare them between individuals and populations.
- Sequencing base-pairs: Mitochondrial DNA and ribosomal RNA sequencing help to define maternal inheritance. Nuclear DNA sequencing helps define Mendelian inheritance. Single-locus genomic sequences can help determine if the organism is a subspecies or part of a superspecies.

THE GPS TOOLKIT

GLOBAL POSITIONING SYSTEMS (GPS) BY MICHAEL K. STONE

Accurate pacing, compasses, and night-sky navigation now share the outdoors with GPS systems and laser range finders. Field collection will never be the same.

GPS allows field researchers to pinpoint the location of observations (reportedly to within an inch or less with the most sophisticated systems). The US Department of Defense (DOD) manages a constellation of twenty-four satellites in high-altitude orbits, which continuously broadcast precise time and position data. By measuring the interval between transmission and reception of satellite signals, and triangulating data received from at least three satellites, a GPS receiver calculates a position fix, and displays it as longitude/latitude, map grid, or military grid coordinates. For species inventories, it makes for much more useful reporting than old systems that referenced names of towns, political boundaries, physical features, or other changeable markers.

In May, GPS became faster, more accurate, and less costly when President Clinton turned off the DOD's selective availability (SA) system. Using SA, the Defense Department had intentionally corrupted satellites' timing signals, in order to make readings less accurate to potential hostile users.

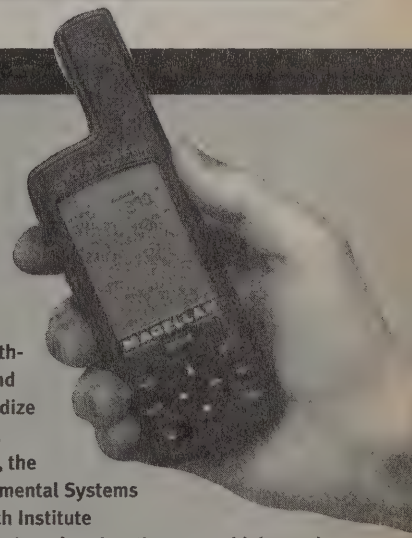
The basic item in a GPS "toolkit" is a GPS receiver. Most are manufactured by Garmin, Magellan, or Trimble (see their company-name.com Web sites or a mail-order catalog such as Ben Meadows Company, 800/241-2068, www.benmeadows.com). Prices depend on how much accuracy you need (accuracy is also affected by how many satellites can be "seen" from your location), and whether you want to connect your unit to a computer or use Geographic Information System (GIS) software. A "navigation-level" GPS receiver (e.g., a Magellan Pioneer) costs less than \$100.

To save and transmit data electronically, add a computer. To receive and send data in the field, add a wireless modem. GIS software (see *Whole Earth*, Fall, 1998) lets you organize data, plot it on maps, or integrate it with a wealth of other information. It can customize data collection forms to simplify

data gathering and standardize reports.

ESRI, the Environmental Systems Research Institute (www.esri.com) makes the most widely used GIS software, and offers many free downloads on their Web site. ESRI's Conservation Program (www.esri.com/conservation) offers assistance, including grants, to help nonprofits working in conservation, environment, and indigenous peoples acquire software and upgrade their GIS capabilities.

The biggest issue for groups putting together systems may be compatibility. Not all receivers, computers, and software work together. Charles Convis, ESRI Conservation Program director, rigged up one compatible palmtop field data collection system that gives two-meter accuracy, and GIS, for less than \$500, using a Magellan 310 GPS, a Compaq Aero 2100 palmtop, and Arc/Pad GIS software.



What's in an Animal's Name?

by John E. McCosker

Adam (purportedly, the first *Homo sapiens*) was the first taxonomist of record, as Genesis 2:19 relates: "And from the ground the Lord God formed every beast of the field, and every fowl of the air; and brought them unto Adam to see what he would call them: and whatsoever Adam called every living creature, that was the name thereof." Scientists disparage Adam's word-smithery. They care little for common names, particularly when so many unrelated animals have the same name (e.g., "cod") or the same animal may have dozens of names around the world.

Modern taxonomy was born in 1753 when Swedish botanist Carolus Linnaeus devised the system of binomial nomenclature and assigned a unique name for every plant and

animal. First came the genus (plural *genera*), to include closely-related species, followed by the species (plural *species*), the biological equivalent of a registered trademark. Genera were combined into families, those into classes, and so on up to the kingdoms, including Animalia and Plantae. From this hierarchical classification a person can glean a wealth of

implied information about common ancestry and shared characteristics. In the eighteenth century, Europeans thought that Earth harbored a few

thousand species. We expanded their view to more than a million in the last century, and with modern collecting in tropical forest canopies and the deep sea, the numbers may approach 30 million.

Naming rules, as established by the International Commissions on Nomenclature, are fairly simple. Every species of plant, animal, or fungus, living or dead, can have but one name, and it must be unique. It must be published in appropriate literature under special conditions and, now, a holotype (a specimen that represents the species; see page 47) must be selected and made available to others to study. (No holotype existed for *Homo sapiens* until 1959, when Linnaeus was so designated; some wags had suggested Nikolai Lenin, who is a male of the species and on public display, but the idea never flew.) Most names are derived from Latin or Greek (hence the oft-used but erroneous term "Latin name"). The Commission requires that scientific names use the Latin alphabet, but allows arbitrary combinations of letters, and recommends that names be sonorous and appropriate to the subject.

A quick glance through a field guide might now make more sense. *Euphagus* ("eats everything") *cyanocephalus* ("dark-blue head") fairly well describes Brewer's Blackbird. *Tyrannosaurus* ("terrible lizard") *rex* ("king") says it all. The Hoopoe (*Upupa epops*) is euphonorously named for its call. Suffixes which describe the location of a species (such as *Buteo galapagensis*, the endemic Galapagos hawk) end in *-ensis*. Creatures are often named for colleagues, kin, or deserv-

ing icons. For instance, a fish was named *Zappa confluentus* by a fan of Frank's, and a fly was named *Dicrotendipes thanatogratus* ("dead" and "grateful"). I once named a gnarly, toothy eel for an occasionally irascible scientist; the favor was returned by colleagues who befitted morays and slime eels with *mccoskeri*. Other names, when taxonomists get creative, take on a whole new meaning. That is where the fun begins. A molluscan biologist assigned *Abra cadabra* to a bivalve, and an arachnologist created *Draculoides bramstokeri* for a blood-sucking spider. Insects and their names such as the wasp *Lalapa lusa*, a beetle *Ytu brutus*, a nasty chigger *Trombicula fujigmo* ("f_ k you Jack I got my orders," soldier talk from WW II), a cockroach *La cucaracha*, and the parasitic horsefly *Tabanus balzaphyre* become more than just bugs to the cognoscenti.

In fact, there are so many bugs that entomologist Terry Erwin of the Smithsonian Institution (page 45) claims he has 2,000 species of ground beetles of the genus *Agra* awaiting names. He started with place names like *Agra costaricensis* and famous explorers (*Agra batesei*) and features and shapes (*Agra elongate*, from very long). But soon his frustration resulted in *Agra vate*, *Agra vation* and *Agra phobia*, and homage to names of impressive humans: *Agra dax*, *Agra katewinsletae*, *Agra othello*.

The longest name I know is *Brachyropuskyodermatogammarus greivlingwmnemnotus*, which in picaresque type is twenty-five times longer than the Lake Baikal shrimp it describes; for brevity, I prefer *Aha ha*, a wasp.

I am fascinated by one of Linnaeus's earliest names—*Chaos chaos*. Perhaps he was prescient. ☞

John E. McCosker is a senior scientist and chair of aquatic biology at the California Academy of Sciences in San Francisco. He studies white shark attack behavior and deep-sea fishes, has written nearly 200 popular and scientific articles and books, and has dived and fished in all of the world's oceans.

Excerpted with permission from www.verde.com.



The Clover. The Plover.

The Plover and the Clover can be told apart with ease, By paying close attention to the habits of the Bees, For ento-molo-gists aver, the Bee can be in Clover, While ety-molo-gists concur, there is no B in Plover.

WHAT IS A SPECIES ?



Prokaryote cell.

Eukaryote cell.

Since the all species inventory sits firmly on the art of describing species, we have included some short essays on how taxonomists go about it (pages 45–47). Describing a “distinct kind” is a bit tricky and, among some life-forms, apparently impossible.

At this moment, three developments—molecular biology; detailed fieldwork and population surveys; and the recognition of the microcosmos—have subverted the last century’s confidence in the “species concept.” This concept, around since the days of French naturalist Georges de Buffon, a contemporary of Linneaus, defines a “species” as “a population of actually or potentially reproducing organisms.” Embedded in this definition are assumptions about biparental sex, two-gender sex, sex itself—all allegedly required for reproduction. And since, in most of our minds, only adults reproduce, the species concept is prejudiced in favor of fully-chromosomed adults (instead of, let’s say, describing an

insect species by its larvae, which may have very different genetics). Finally, to prove that two different species are not “potentially reproducing,” the taxonomist should demonstrate that they *cannot* reproduce, even if they share the same petri dish, terrarium, aquarium, or cage.

The centuries-old definition is slowly being picked apart. This is not the essay to describe the recent deconstruction of classic biological thought, but examples that will perplex inventory workers provide a peek at the problem. Where I hang out in southeast Arizona, every whiptail lizard found for decades was female. The need to find males revved the enthusiasm of collectors, who scoured the desert grasslands with their lizard-catching sticks-with-a-noose. Many specimens later, skeptics conceded that there were no male whiptails. It is an all-female “species” that mates with itself (parthenogenesis), avoiding the hassles of courtship, and does just fine (if not better) than species that have to seek out and court mates. There are now well-documented single-parent sponges, jellyfish, corals, flatworms, rotifers, mollusks, insects, centipedes, liverworts, ferns, and flowering plants, as well as lizards.

Old-timers claim that these uniparental species are mere derivatives of good old heterosex, and are found only in colonizing niches where finding mates is hard. But this claim just doesn’t quite work. From an all species overview, demanding that each species demonstrate two genders, with both genders required to produce offspring, would eliminate too many uniparental “species.”

Vladimir Nabokov (page 36) challenged the “potentially reproducing” part of the species definition. He just couldn’t envision testing a species of European butterfly that looked similar to a North American species by taking specimens across the sea and forcing them to have sex in the same glass house. In fact, when scientists *do* mix two related species in cages they often mate. Horny tigers and lions will court, mate, and produce fertile tig lions and ligers. By the “potentially reproducing” definition, tigers and lions should be lumped as one species. Old-timers claim that the artificial nature of the experiment does not invalidate the species concept. Lions are not tigers. So one has to add “under natural circumstances” to the classical definition, and that opens another can of worms, especially as many species have come into contact as the result of human fiddling with the environment.

Left: Prokaryote cell, with no nucleus and a rotary motor flagellum (tail). The eukaryote cell evolved into fungi, plants, and animals. A species group may be described by the differing components within the cell such as a nucleus, chromatin, undulipodium (the tail), large ribosomes, etc. as well as the similarity of its RNA and DNA. This “organelle” definition is only a decade or so old.

The organisms that have permanently undermined the old definition are the nonnucleated life-forms (prokaryotes). They do not need to mate to reproduce. They are clonal, reproducing like photocopying. They can pass along genes to each other, but this has nothing to do with gender (as far as we know). Prokaryotes subvert the species concept. Some can even scavenge new DNA that other bacteria have excreted back into the environment. Not only bacteria, but also archaea, small fungi, and anaerobic (without oxygen) protocists (page 14) just don't fit the "species concept" as written above.

When in doubt, taxonomists like to stack up similar vs. different features. Bacteriologists like to claim that two lab cultures contain the same "species" if they have 85-percent similar traits; in reality, bacteria with nowhere near the 85-percent similarity level transfer genes. This remarkable ability is why many antibiotics don't work after a few years, why TB has had a resurgence, and why many pesticides ultimately fail. The "super-organism" gene-transfer promiscuity is perhaps how the whole planet stabilizes its atmosphere and allows us to live. Microbiologists such as Lynn Margulis and Sorin Sonea suggest that "higher organism" criteria for species may not work for prokaryotes. Prokaryote genomes are simply an improvised way to get something done. If the resulting life-form doesn't work,

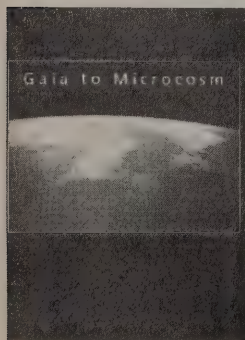
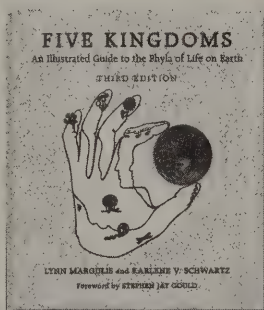
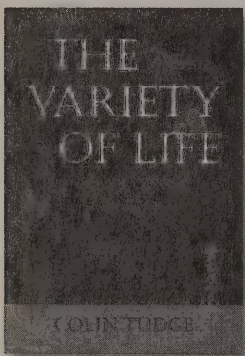
they swap enough genes until the new combo does.

To keep prokaryotes off the planetary life list because they don't fit a classic species definition seems an act of denial. Nonnucleated life-forms add perhaps one to three million very dynamic "kinds." If we add the micro-fungi and other asexual and quasi-sexual life-forms, we might add still another 400,000 to 800,000 kinds.

And viruses fit no part of the species definition. The last century demonized them as latecomers, protein robots, and nonliving parasites, but they are intimately and actively part of life. Viruses and phages could add another million kinds.

In short, the "new" species concept is probably not a concept but a set of concepts. Admitting that life has many ways to accomplish its perpetuation, we should not impose a universal "higher organism" definition on "lower organisms." As the all species inventory unfurls, I see different species definitions for each historical line of life. Features of these definitions may include the DNA/RNA that sets up the proteins, the symbiont cell parts that energize life and manage the construction of cells and organs, and the oddball ways that life-forms grow up and behave. With this much going on, the drama of life should remain, both philosophically and empirically, alive and hopping. —PW

WHOLE EARTH TAXONOMY ACCESS



THE VARIETY OF LIFE A Survey and a Celebration of All Creatures That Have Ever Lived

Colin Tudge. 2000; 684 pp.
\$49.95. Oxford University
Press.

PROKARYOTOLOGY A Coherent View

Sorin Sonea and Léo G.
Mathieu. 2000; 105 pp.
CDN\$22.95. Les Presses de
l'Université de Montréal. Or
from Fides, 514/745-4290.

FIVE KINGDOMS An Illustrated Guide to the Phyla of Life on Earth

Lynn Margulis and Karlene
V. Schwartz. 1998 (3rd ed.);
520 pp. \$29.95. W.H.
Freeman.

GAIA TO MICROCOSM Volume 1 (video and book)

Lynn Margulis and Dorion
Sagan. 1996; video and 108-
page book, \$93.95. (\$98.95
postpaid), Kendall/Hunt, PO
Box 1840, Dubuque, IA
52004-1840; 800/228-0810.

Here are the best books to start out in whole earth taxonomy. They focus on classification, not species description. *Five Kingdoms* is still my favorite, carefully laying out the phyla of all creatures on the planet and giving even weight to all life-forms. It is more difficult reading than *The Variety of Life*, because *Five Kingdoms* sticks to the lingo of professional biology; it is more of a desk encyclopedia. It definitely subverts the "tree of

life" metaphor, by showing that life is more like a braided river than a tree, with creatures flowing together by symbiosis to build new species downstream in evolutionary time. The video is a graphic intro to protocists.

Colin Tudge is readable and chatty. He is part of the new school of "cladists" and DNA-enthusiasts who have called into question many of the classic lines drawn between species, genera, families, etc. Once you let DNA into the taxonomic game and insist that taxonomy be based only on ancestral characters (which, for instance, makes crocodiles closer to birds than lizards), the old hierarchy begins to shudder. Are guinea pigs rodents? *Variety* is an "impressionistic cladism" (Tudge's term). I like that his fuzziness admits ignorance, but I get distracted by his question-

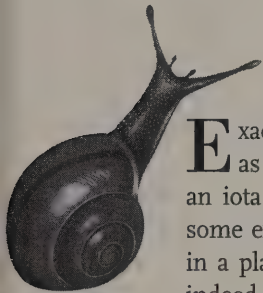
able quest to rewrite so much of historical taxonomy. He emphasizes those critters which we all love best (big and heteroexy).

Prokaryotology (the study of the nonnucleated life-forms) is the strongest and clearest book demonstrating the validity of the Gaian Hypothesis. It introduces new vocabulary for gene transfers and many believe-it-or-not activities about microbial existence. The book makes—and then backs up—remarkable assertions such as this: "The prokaryotic world behaves as a global system or superorganism of elements capable of solidarity. It has continually improved the life-supporting capacity of our biosphere and constitutes the main positive ecological factor of our planet." —PW

Lumpers & Splitters

THE WORLD LIST OF SPECIES GOES UP AND DOWN WITH NEW PERCEPTS, CONCEPTS, AND TOOLS.

by Terry L. Erwin



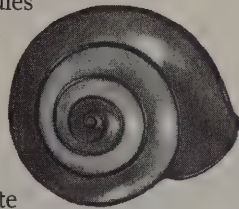
Drawings by Alan Male

Exactly how does a species become recognized as a “new” species? Most folks who have given an iota of thought to the question might answer: some explorer discovers an unknown species deep in a place like the Amazon and names it. That is indeed one way to become a species newly named to science. However, there is another way: *splitting*.

Taxonomists must follow rules and recommendations of the science community’s international codes. They must state exactly which specimens were studied during the naming process, and to indicate where those specimens can be found—normally in a natural history museum such as the Smithsonian Institution or the California Academy of Sciences.

The last time I visited Paris, not only did I have delicious food and wine and conversations with my taxonomist friends, but I found, in a box in the entomology hall of the enormous Musée National d’Histoire Naturelle, a series of beetle specimens named *Agra castaneipes* by the famous Amazon explorer Henry Walter Bates. Using a high powered microscope (unavailable to Mr. Bates in his time), I discovered that his ten specimens actually represented two different kinds with quite different characteristics—three specimens of one and seven of the other. Where Mr. Bates saw one species, I saw two. My job as a specialist in this group of beetles is to inform science that a previously overlooked species has been found. I do that by describing the new species and giving it a name. I split Mr. Bates’ specimens into two boxes, labeled them appropriately, and will publish a paper describing my discovery and the new species. Thus, by my “splitting” the series into two groups, each representing a different species, the World List of all species will grow—just as it would if I discovered a new species in the Amazonian wilderness, where I have spent twelve years of my life collecting.

The land snail *Cepaea nemoralis* has incredible variation in colors and banding, but is still the same species. When to decide that differences mean a new species is the taxonomist’s dilemma.



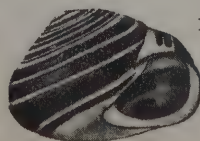
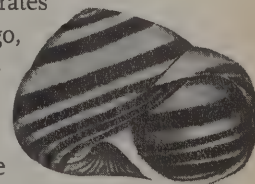
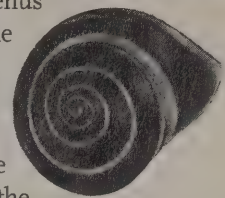
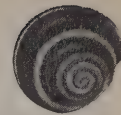
Splitting can occur at any taxonomic level. For example, my friend and colleague David Kavanaugh of the California Academy of Sciences and I studied a rare group of beetles from five specimens. These were described as two species in one genus called *Cicindis*. One of them lives in the Persian Gulf. It was called *Cicindis john-beckeri*. The other is found in northern Argentina and is called *Cicindis horni*. As a result of our study, we concluded that the peculiar trans-Atlantic distribution was the result of continental drift, the splitting apart of Africa and South America. These beetles had separated at least 60 million years ago, and have quite different characteristics. Therefore, we described a new genus, *Archaeocindis*, to contain the Persian Gulf species. But note that changing the genus did not change the number of species on the World List. It only changed the number of genera.

On the other hand, a species and its name, metaphorically speaking, can go extinct! That is, it can drop off the World List. This process is called “synonymization.” Sometimes (especially in the past when communication was difficult) two distinct names were given by taxonomists to individuals later recognized as the same species. When that happens, the older name is usually kept and the more recent name dropped into “synonymy,” and hence off the List. Now we have one species where there were once two and the World List has lost a species name. In the vernacular, this is called *lumping*.

Taxonomists are often called “splitters” or “lumpers” by their colleagues, depending upon their personal broad or narrow approach to recognizing species, the technologies available, the degree they rely on field observation, the taxonomic group they specialize in (e.g., the definition of species is more ambiguous among fungi than among animals), and current “fashions” in taxonomic research (e.g., emphasis on molecular aspects of a species as opposed to its body parts).

The World List goes up and down. Synonymy, of course, reduces the number of species. So does deciding that a group of species is really one species with many races or subspecies. This frustrates birders who keep life lists. Just a few years ago, three species of flicker (Yellow-shafted, Red-shafted, and Gilded) were found to interbreed extensively in the Great Plains and Canada. The three species were lumped. They became races; birders lost two species from their Life Lists.

On the other hand, deciding that a subspecies or a race is actually a “good” species raises its taxonomic rank, and increases the number of species. Happy



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birders recently discovered that the American Ornithological Union had split two races of the Brown Towhee (a ground-dwelling, friendly, brownish, large sparrow-like bird) into two species (the Canyon Towhee and Brown Towhee). Without leaving home, many added a species.

Lumping and splitting may have serious consequences for an all species inventory. In 1979, for instance, 2,116 beetles were reported in the *Zoological Record*. But 426 were referred to synonymy, a few resurrected from synonymy (became “good” species once again), and a few lost their species rank and became subspecies. The net gain was 1,689 beetles (about 80 percent of those described). Groups like butterflies (Lepidoptera) and moths (Noctuoidea) have experienced even greater losses and gains from lumping and splitting. Only two out of three species gain a firm hold on the World List. One-third

drop into the ignominy of synonymy.

An animal or plant species is defined as a reproductively isolated population of individuals or set of populations. Most new species are assumed to be “reproductively isolated” because the taxonomist finds among specimens in museum collections different characteristics that presumably prevent fertile matings. But taxonomists rarely actually test interbreeding with live animals or plants to see if they could actually produce healthy, fertile offspring. Herein lies a danger: defining which features of a specimen pertain to successful courtship, mating, and fertility can be tricky.

However, experienced taxonomists are pretty good at sorting out character patterns and generally recognize “true” species. We occasionally encounter classifications from a historic figure such as Thomas Lincoln Casey, who lived in early twentieth

century America and described several thousand new species without any sense of character variation. In the 1960s Professor Carl Lindroth, a Swede, undertook a study of Canadian ground beetles, many of which had been described by Casey. He found that only 7 percent of Casey’s names were valid; 93 percent fell to synonymy.

A species description is indeed always a scientific hypothesis that can be tested with new information, such as characters found with a more powerful microscope, behavior, life cycles, geographic distributions, or lately, cell organelles and DNA/RNA analysis. The story of splitting and lumping is actually one of taxonomic refinement through time. Being a *known* species, of course, is in the eye (and publications) of the taxonomist. Living in nature, whether known and named by humans or not, a species simply is. **we**

BIOPAT: IMMORTALITY FOR SALE www.BIOPAT.de/english/

by John E. McCosker

Ever since Linnaeus, systematic biologists have named new species in honor of relatives, royalty, colleagues, and kin—and often to recognize the backers of their expeditions. The practice of “patronymy” rewards science patrons with specific epithets, so *vanderbilti* and *victoriae* are common across many phyla. Although this honor is often expected, the sugar daddy is never guaranteed scientific immortality. Now, however, a new name for a frog (or other new species) can be purchased over the net for a few thousand bucks. And some scientists are hopping mad.

In December of 1999, a German organization of museum professionals (Gesellschaft für Technische Zusammenarbeit) formed BIOPAT (“Patrons for Biodiversity”), a nonprofit association that will name new species as the donor wish-

es. Its Web site displays Madagascar frogs, a Bolivian orchid, a Chinese spider, and a Vietnamese viper awaiting names. The opportunity to name proboscis worms or parasites for friends or patrons will surely evolve. Half of the “donated” funds (currently 5,000 DM, about US\$2,500, per species) go to the institution that performs the taxonomic research. The remainder will be used to protect biodiversity in the country of the species’ origin. BioPat reports that nearly 10,000 new species of plants and animals are described each year. The describers can’t keep up with the discoverers.

One can’t argue that selling names doesn’t help cash-strapped research institutions or help to protect beleaguered habitats. However, many scientists fear the inevitable arrival of taxonomic cowboys devising spurious science for profit. Proponents point to the

London-based International Star Registry, which peddles the opportunity to name asteroids and stars. The Star Registry is not comparable to BioPat, say astronomers and astrophysicists, such as Nobel Prizewinner Charles Townes, who consider such star names to have no validity and to be inconsequential to their science. The biological names are a different story. If the rules of the International Commission on Zoological Nomenclature are properly followed (they are currently flexible enough to allow this), Commission secretary P.K. Tubbs at the British Museum fears that “many vendors could ‘discover’ species and invent genera for profit and many such names would irreversibly obscure science and hinder conservation efforts.”

At this time, the Commission is pondering whether to accept names that have been bought. In terms of future species pur-

chasing, the reader should keep in mind the sad but telling story of the immortality of biological nomenclature. A butterfly taxonomist created the genus *Gretchena* for a woman friend. He sequentially named new species *Gretchena delicatana*, *Gretchena dulciana*, (sweet) *Gretchena amatana* (beloved), *Gretchena concubitana* (possessed), and finally, *Gretchena deludana* (deceived).

Excerpted with permission from www.verde.com.



A Coleopteran swimming beetle from Asia. Its Genus is *Neptosternus*. For \$2,500, you can name this species!



Name this Inch-long, fairy-shrimp-like isopod from Antarctica. Hint: it has a marsupial pouch and its young emerge as mini-adults. \$2,500.

Typecast

The Codes of Nomenclature

by Terry L. Erwin

The Holotype of the bombardier beetle, *Brachinus aabaaba*, which I named and described in 1970, is housed in the Museum of Comparative Zoology at Harvard. Any taxonomist who would like to see my selection of an ideal representative of this beautiful, sleek, wedge-shaped blue and red species that lives in México would go visit the MCZ or write to borrow the specimen, especially if they had a hard time interpreting my description (which certainly does occur because it is very difficult to accurately describe beetle attributes in words).

In order to tie a name to a species, a taxonomist selects one preserved specimen (or living culture for certain microbes) to bear the name, forever. In animals, including insects, the single specimen responsible for bearing the name is called a Holotype. The Holotype is well preserved in a museum, herbarium, or living culture collection and can be referenced by a taxonomist as a check against misusing the name for another similar species. Other specimens that share the Holotype's physical and genetic characteristics will be regarded with the same name as that borne by the Holotype.

I named this species, *aabaaba*, because I wanted my name to be first on any list of all animal life. Under the *Code of Zoological Nomenclature*, any combination of letters is valid no matter how barbaric, if pronounceable. I thought this species would live forever at the top of the list. Then along came my friend, James Liebherr (Cornell University), whose speciality is Hawaiian beetles. Using the Hawaiian word "a'a," meaning the rough, nasty kind of lava, Jim named a species, *Atelothrus aae*, which is the Latinized form of a'a. To see the Holotype of that now top-of-the-list species, one would have to go visit the Bishop Museum in Hawai'i. It's tough to be second on the list—it's kind of like being a Paratype.


Paratypes are all those specimens beside the Holotype, of the new species represented on the desk of the taxonomist at the time of description. Para means beside, hence beside the type. It is not only rough having a pin through your body, it's even worse if you're a lowly second-class Paratype. But

not to give up hope, if for some reason the Holotype is destroyed (dermestid beetles infesting insect collection and eating the specimens, for example), a taxonomist would have to select a Neotype to replace it. That Neotype (the "new" Holotype) would undoubtedly be from the Paratype series of specimens. So, there is always a chance at triumph, maybe.

Browsing through large museum collections, one might find all kinds of labels on specimens with words that end in "type," such as "Topotype" (coming from the same place as the Holotype), "Allotype" (equals one of the Paratypes, but of the opposite sex from the Holotype), "Homotype" (a specimen compared to the Holotype by an expert in that group). None of these are truly significant. Only the so-called primary types,—Holotype, Neotype, and Lectotype—have any weight as name bearers.

A change in the *Code* many years ago and advances in technology brought about the "Lectotype." Early taxonomists employed "syntypes" or a series of specimens to bear the taxonomic name. As it turns out, with microscopes and DNA analysis and additional field-work, we see defining characteristics better and we now know that many of these syntype series consist of more than one species. Today's taxonomists have to make a decision as to which of the two (or more) specimens found among the syntypes should keep the original name and which gets a "new" species name. Also, even when splitting isn't necessary in a syntypes series, the taxonomist usually selects one as the Lectotype and it then bears the name forever, just as a Holotype does.

This whole process is designed to stabilize the nomenclature of a complex natural world replete with species, so we don't live in a taxonomic Tower of Babel. While stabilization of names is a good thing, the historical search for the original specimen (the true Holotype) can occupy an extraordinary amount of a taxonomist's time.

Words by themselves can't prove the existence of anything. Some vouchered proof of a species' existence is mandatory, especially since we are at the onset of the Sixth Extinction Crisis. Many of today's species will not be here in a few decades. At that time, without physical evidence, will our grandchildren and great-grandchildren believe the world contained such biotic richness and natural beauty? 



Typical botanical specimen.

The all species project is humongous. Designing the right human organization will make it or break it. Many nations (especially in Asia and Africa) insist that they receive money when allowing an inventory. It is not like the old days—scientists getting a visa, hiring locals, and packing out the specimens. The new partnerships can be simple. In Indonesia, for instance, botanists from Harvard's Arnold Arboretum work with in-country counterparts to collect plants. The National Cancer Institute (NCI) pays for the cost of collecting and screening with US taxpayer dollars. Indonesia receives properly identified duplicates of all collections, as well as the results of screening. So far, about 5,000 plants have been added to their Borginese Herbarium.

The Arnold Arboretum participates only in discovery and ID, never commercialization. As a non-profit, it cements intellectual relations with Indonesian compatriots. In a way, the Arboretum is an emissary of goodwill and secular, nonpolitical networking. NCI makes all the financial deals for development of potential anti-cancer drugs.

Tantalize nations with dreams of profit from genes, and the organization of benefit-sharing becomes complex and intense. Here's a successful example. The National Institute of Biodiversity (INBio; a Costa Rican private nonprofit, page 32), Diversa (a San Diego-based biotech firm), and the Ministry of Environment and Energy (MINAE; the Costa Rican government agency that oversees biodiversity) signed multiple agreements. A three-year contract with Diversa empowered INBio to further its goal—inventorying all the life of Costa Rica. Under the contract, INBio searched the mangroves, coral reefs, forest soils, and tropical leaf litter for microbes living on insects, nematodes, and epiphytes. INBio staff learned to look for microbial symbionts, a huge gap in the world inventory. The agreement helped INBio learn even more about what conservation of its genetic resources entails, and gave its employees value-added experience as the best bioprospecting outfit and DNA analyzer in Central America. Diversa funded a DNA processing lab for INBio (shifting DNA analysis and expertise from the US to Costa Rica), paid the salary of a local molecular biologist, and trained her in San Diego. It funded the collection and taxonomic work by INBio staff.

INBio, in turn, promised not to use Diversa equipment to supply DNA to other companies, but retained rights to provide other companies with

DNA from the same environments. It made an undisclosed agreement on royalties, should any of its findings become profitable. Both INBio and Diversa agreed to do no harm to the environment.

Diversa specializes in enzymes and DNA. It has looked in Costa Rica for enzymes for biomass conversion (making ethanol), improving animal feed, and loosening up residual petroleum in old well fields; and genes for transgenic crop protection and pharmaceuticals. Diversa likes INBio. The process of negotiating agreements usually takes three-and-a-half to four years. With INBio, it took two months. The agreement provided access permits to Costa Rica's Conservation Areas and ensured Diversa property rights over the DNA. Diversa sends their clients derivatives, not the organisms or even the names of the organisms. In that way, Costa Rica, which owns the organism, protects itself from biopiracy and must be consulted for any further supply.

Finally, MINAE receives 10 percent of the bioprospecting budget from INBio and 50 percent of any royalties. (These revenues can only be used for conservation). It oversees the permits and insures that no harm results from bioprospecting.

Amazingly, "intellectual property rights" (IPR)—the principle that you own what you know—was not a horrifying bump in the road. Diversa got what it wanted: access to where the species dwell, high-quality collaborators, and high-quality samples. Of lesser importance, it ensured re-supply with germplasm, received permits with relative ease, and paid a reasonable fee for samples and collection. Intellectual property rights were not an issue in Costa Rica, perhaps because Costa Rica has few indigenous peoples.

JIVARO KNOW-HOW

In contrast, consider the Jivaro peoples of Peru/Ecuador. These lowland Andean communities include the Haumbisa, Aguaruna, Shuar, and Achuar. There are 140 Hambisa and Aguaruna communities living along the Peruvian rivers. The Jivaro have medicinal plants desired by the multinational Monsanto-Searle. A group called the Peru International Cooperative Biodiversity Group (ICBG) refereed complex agreements. The group included Washington University (St. Louis), working under a grant from the US National Institute of Health (NIH); two Peruvian universities; Monsanto-Searle; the Peruvian government; and several clan organiza-

tions, each speaking for a different Indian community. (The Shar and Achwar did not participate. Though they share plant knowledge, they live in Ecuador; an unresolvable inequity arose, owing to national boundaries.)

At first, it seemed simple. An agreement would be made between the permit authorities and those Aguaruna who were experts on medicinal plants. But then negotiations bogged down. Did these individuals speak for their communities? What if some communities want to share their knowledge, but others do not? What is equitable benefit-sharing? Should those who are more knowledgeable receive more? Global science and technology had deeply intruded into old culture decision-making patterns.

ICBG struck this balance: Short-term and medium-term advance payments and research employment will go to the clan organizations and communities most actively involved. Everyone signed a “biological collecting agreement” about fees and where,

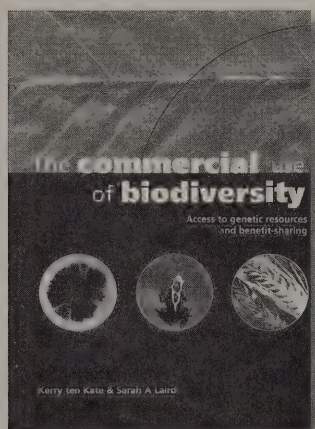
by whom, and under what circumstances collecting could occur. *And* a “know-how” agreement establishes fees paid to Aguaruna experts while Searle picks their brains. *And* a “museum-and-universities agreement” funds collecting, housing, and curating specimens. *And* a “crude plant extract agreement” establishes ownership. Long-term benefits, such as royalties from a successful product, would go to all communities and the collaborating universities.

These agreements clearly acknowledge Aguaruna ownership of their knowledge, assure prior consent, and establish confidentiality about their know-how. Aguaruna individuals or the community may file patents. The Aguaruna retain ownership of plant extracts. In turn, the Aguaruna acknowledge the need for permanent collections, not-for-profit inventories, and Peruvian government ownership of the genes.

Latin America strikes deals more easily and simply than Africa and Asia.

The Arboretum model is rare. The complex indigenous/commercial model is more common. I can't imagine a unique cookie-cutter model for an all species inventory. (Thank goodness, people are as diverse as their ecologies.) But the principles of a workable model are emerging. Give the nation involved the capability to continue its own inventory and interest in natural history. Include prior informed consent; some sort of benefit-sharing (sample fees, royalty payments, nonmonetary help such as enhancing herbaria or donating lab equipment and training); and serious consideration of the national laws. It requires elegant diplomacy.

In many places conservation did not rise up from grassroots citizens pressuring their governments. The all species inventory can catalyze locally committed natural history organizations and conservation. Looking for models for “sustainable” human life of the planet? The all species project might be the place to start. —PW



THE COMMERCIAL USE OF BIODIVERSITY

Access to Genetic Resources and Benefit-Sharing
Kerry ten Kate and Sarah A. Laird. 1999; 398 pp. \$85. Earthscan Publications.

No agenda except to tell you more about how the system works. It gives no Captain Hook Awards for Biopiracy. You learn, as in no other book, how

species wind up as pharmaceuticals, botanical medicines, major crops, horticultural plants, crop protection, cosmetics, and personal care products—industry by industry and in informative detail. You learn about all the organizational hassles that will hopefully protect the people in nations-of-origin (many laws don't work because they are just being invented; many don't apply, because the plant germplasm was transferred to a botanic garden or culture long before anyone was interested in biotech). The book's strongest theme is benefit-sharing (fees per sample, royalty payments, nonmonetary

transfers of training and equipment); as well as prior consent to access plants and microbes that may (after ten years of development) make millions or billions. The prose is clear, if legalistic. It's essential reading on how the inventory and commercialization of species actually operates. —PW

“ Intellectual property rights

Bixa is widely known and used throughout the neotropics, and is available in any market-place in the region. The agreement between Aveda and the Yawanawa was therefore not based on the use of restricted traditional knowledge, and does not involve commercialisation of a product previously used only at a local or subsistence level. The collaboration was based on the Aveda company's desire to avoid “prospecting” for new species. The second product under consideration by Aveda for commercialisation is pupunha, which was planted alongside the bixa trees....This was a central point for the company. As May Waddington said, “This project was intended to strengthen the community and its ability to preserve the forest and their style of life; it was not intended to uncover a ‘miracle’ plant.”

With the generous assistance of Tony Burgess

Volumes of species data and knowledge swirl in the heads of aging taxonomists and naturalists, with no place to settle. Data sit in about 10,000 paper publications, only a fraction of which can be found in libraries. Species info is starting to circulate on CD-ROMs, but most CD-ROMs and online services only carry species information collected since 1970. The grand days of natural history have no vivid presence except to those who snoop in dusty drawers and special collections. Can the books, journals, directories, databases, field and lab notebooks be harmonized? Can the babble of field guides, floras, faunas, ID keys, and monographs be coordinated (or, at least, networked)? Can collections be cataloged so that anyone can find where the specimens reside?

Bioinformatics—the gathering, manipulation, classification, storage, and retrieval of recorded knowledge about life—plays the twin to discovery/description in the all species inventory. Here are the tasks:

• Digitize the Master List of Species Names

Noah's checklist for the ark requires an unprecedented combined effort by digital technologists and planetary ecologists. We might be adding 28 million to 90 million new names. Standards for which species names are acceptable will hasten the completion of the Master List.

• Digitize and Link Existing Taxonomy Collections, Species Names, and Natural Histories

Linking new and old archives will create the virtual museum of Earth. Even fossils could eventually be included. Specimens will be locatable, and images could allow taxonomists to save on air fare. Who has custodianship of these huge databases is the challenge.

CONABIO www.conabio.gob.mx

The Mexican National Commission for Knowledge and Use of Biodiversity, its first task has been compiling information about Mexican flora and fauna held by museums and herbaria throughout the world. They're assembling the labels on Mexican specimens in foreign collections and computerizing their findings, making deals to repatriate some of the specimens, and planning to inventory for old and new species in specific locales. They train parataxonomists, work to eradicate invasives, support sustained use of species (such as tropical butterflies) and raise public awareness. CONABIO channels public funds to a private fund which administers the projects. With about 15 percent overhead, around \$5 million goes into projects. CONABIO has advisory powers only, but is asked to advise on everything from contracts with pharmaceutical companies to indigenous groups.



• Link GPS, GIS Grids, and Maps

After "What did you see?" natural history's question is "Where did you see it"? The data come from field notes and museum labels. Researchers dream of a master GIS grid library where every finder of new species could locate what he/she saw and then link the information to local grids.

• Link Molecular Databases to Species Descriptions

There are no electronic linkages between molecular databases of "species" and their names and descriptions. In fact, many molecular biologists do not even keep the creatures from which they extract DNA/RNA. This causes great confusion if names change or need to be reconfirmed.

Digitizing and linking will hasten "repatriation" of knowledge now stored in Europe and North America back to former colonies (see CONABIO). The ecoregions will again be custodians of their own collections, both physical and virtual.

Conservation knowledge should accelerate by deploying search engines to pull up all locales by organism, and all related organisms by locale. What's lost (or about to be) will become immediately apparent. Also, duplicate names for the same species from different locales can be quickly harmonized.

In the digitized all species future, kids might learn actual foodwebs rather than today's birds-eat-insects, insects-eat-plants simplifications. Global warming models might include the species with the most moderating influences. Future data systems should reveal the phylogeny and evolutionary relatedness of all life in great detail. And the citizen born with a naturalist obsession should easily find a place to contribute, further obscuring the distance between academic specialists and expert amateurs. —PW

A collection of the songs of endemic and endangered Colombian Andes birds. CD-ROMs are one of the new forms of bioinformatics data collection, management, and dissemination.

ALL SPECIES INVENTORY COSTS

Overall funding fuels the naturalists and nations that want to inventory all resident species. Funders underwrite those aspects closest to their hearts and interests. For example, the All Species Foundation has suggested that support for the bioinformatics and collection/taxonomy aspects come predominantly from the new wealth created by telecommunications and computer technology.

How to determine costs? It depends on what expenses are included at each step, for fieldwork, labwork, archival work, and information storage, dissemination, and reference. Fieldwork costs, for instance, range from plant presses to bathyspheres; hand lenses to DNA probes. Who pays for labor, equipment, and buildings? For taxonomists and parataxonomists;

curators, custodians of databases, and other administrators? Overhead at museums that do IDs? Who pays for storage of specimens in herbaria and museums? DNA extraction of select samples? Training paras and lab and collection workers? Who pays for public educational programs to accompany the inventory? Or legal arrangements, if permits or property rights become an issue? Who pays for bioinformatics to speed classification and data assemblage process?

Kevin Kelly has estimated costs at one to three billion dollars for just describing and collecting species, about \$100 per species for 30 million. In Costa Rica, the original All Taxa Biota Survey of Guanacaste arrived at \$200 per species, assuming supplemental financing for storage, academ-

ic specialists, reference work, etc. For a very expensive project, the Great Smoky Mountains (page 10), costs are estimated at \$1,000 to \$2,000 per species. Including long-term capacity building, conservation education, and training, E.O. Wilson has suggested a cost of \$500 per species (for 30 million species: \$15 billion, or \$600 million per year for twenty-five years).

Undoubtedly, funds for some parts of an all species inventory will come through the United Nations, IUCN, USAID, ODA, CIDA, the World Bank, Conservation International, Nature Conservancy, corporate and individual donors, and many governments.

Framing these public funding/private philanthropy partnerships will require brilliant leadership. Any suggestions?

BIOINFORMATICS ACCESS

This is a very incomplete list, but gives a feel for what's out there. The majority of these efforts have little or no funding.

MAKING THE WORLD LIST

SPECIES 2000

www.species2000.org/specloc.html

Intended to produce a virtual index of the world's known species, with a home page for every species and cross-referencing names given to species.

INTERNATIONAL PLANT NAMES INDEX

www.ipni.org

A collaboration of Kew Gardens, Harvard, and the Australian National Herbarium, attempting to provide a standardized database on plants of the world.

GLOBAL BIODIVERSITY INFORMATION FACILITY

www.gbif.org

Its goals include cata-

logging names of all species on the Web; digitizing natural history collections; a Web site for each species; an online library; and training.

INTEGRATED TAXONOMIC INFORMATION

INITIATIVE (ITIS)

www.itis.usda.gov/plantproj/itis

A partnership of US, Canadian, and Mexican groups and taxonomists, seeking to collect and standardize names of all North American flora and fauna.

BIOINFORMATICS

GLOBAL TAXONOMY

INITIATIVE (GTI)

www.biodiv.org/Decisions/COP5/pdf/COP-5-Dec-All-e.pdf

Created by the Conference of Parties (COP) to the 1992 UN Convention on Biological Diversity to coordinate activities to build international taxonomic capacity in order to meet the goals of the Convention.

See the Web site above for a downloadable 141-page report on the most recent COP meeting, with the latest recommendations for the GTI.

BIONET

www.bionet-intl.org

Intended to help Southern and local peoples develop self-reliance in systematics, through regional partnerships of developing countries, a consortium of Northern institutions, and a technical secretariat.

EMBNET

www.hgmp.mrc.ac.uk/brochure

European network for molecular biology databases.

ASSOCIATION OF SYSTEMATICS COLLECTIONS (ASC)

www.ascoll.org

Washington, D.C.-based nonprofit supporting natural history collections. Its newsletter reports the latest on collections resources.

ASC coproduced the Taxonomic Resources Expertise Directory and the Directory of Systematics Collections, which lists taxonomic groups in collections.



BIRDLIFE INTERNATIONAL

www.wings-wbsj.or.jp/birdlife

BirdLife has the best bird inventory, especially of endemics, and the best bioinformatics coordination of species lists with mapping. Not an all species (nor even all birds) survey, but a model for entering information into databases, networking, and building partnerships.

PARTNERSHIPS FOR ENHANCING EXPERTISE IN TAXONOMY (PEET)

web.nhm.ukans.edu/peet

Competitive NSF grants program to support research of poorly known organisms, train taxonomists, and translate current knowledge into electronic and other formats.

TREE OF LIFE

phylogeny.arizona.edu/tree/phylogeny.html

A collection of more than 1,600 Web pages from biologists around the world. Part of a dream to connect all the parts of life's kinship chart into one big family tree.

BG-BASE

www.rbge.org.uk/BG-BASE

A widely used relational database application designed to hold a range of information relating to taxonomy, distribution, bibliography, conservation, collection management, and people management.

IT'S NO SMALL THING TO OUTWIT TIME

COLLECTIONS & ALL SPECIES



I was seriously curious to see the stuffed skin of the first collected Mt. Graham red squirrel, 2,000 miles from its home, in a cabinet at the Smithsonian. I had been part of a team that “re-discovered” the elusive rodent after it had been declared extinct. The first

naturalist to collect on Mt. Graham, in 1896, knew it was different, and its difference has held for a century, causing all kinds of trouble for astronomers who want to fragment its habitat for telescopes. The skin had no skull, disappointing me. Pretty rodents are best known by their teeth.

Natural history collections, our grandest sense of genealogy, hold memorabilia meaningful to the whole family. Artists, photographers, filmmakers, kids doing nature study, biogeographers, conservation biologists, and activists, as well as taxonomists, shuffle through them for the sake of beauty, curiosity, and amazement.

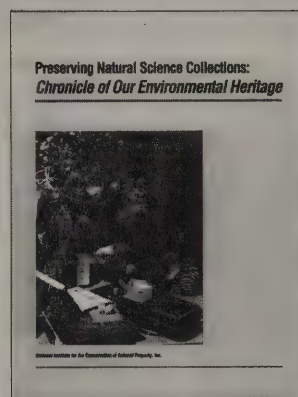
There are 2.5 billion mummified, skinned, pressed, pinned, stained, frozen, pickled, skeletal-bleached, and desiccated dead specimens of species worldwide. Living “specimens” conserve themselves in botanical gardens, zoos, living culture facilities, seed banks, aquaria, insectaries. Add stained slide collections, pollen banks, tissue cultures, and libraries of nucleic acid (DNA and RNA) and protein (amino acid) sequences. The new collection space to house vouchers from a twenty-five year all species survey (increasing from 2 million to, let's say, 30 million) has never existed on any drawing board.

In addition, most specimen collections are hard to access, curated by small staffs, and not cataloged. Many of the accessible specimens remain unidentified. Of those identified, many lie in boxes, but have not been integrated into the collections, or else their poorly curated tags carry misidentifications, have become faded or lost, or have never been updated. An all species survey is perhaps the only pursuit that can reinvigorate these “libraries” and open them to more citizens.

When I daydream under a pine and think of the next ten years, the all species survey fires up a great swapping. Extra specimens in Northern museums return to their ecoregions (see CONABIO, page 50) and all holotypes (page 47) of a group end up in the same location. Museums of carabid beetles for the beetle lovers, fungi for mycologists, etc.—in short, a more rational design for collections, abandoning the imperial past and promoting a decentralized and efficient means of learning.

If new space, more funding, and better access cannot be accomplished, then existing collection curators can't help but become more selective about new acquisitions, and may even need to throw some specimens away. Without the energy of a visionary project similar to an all species survey, the memorabilia of many curious generations will slowly turn to dust. —PW

Below: Deer mice prepared at various dates from the early 1800s to the 1970s. At bottom, X-radiograph reveals preparation methods, including placement of support wires and distribution of metal salts used in preparation.



PRESERVING NATURAL SCIENCE COLLECTIONS

Chronicle of Our Environmental Heritage

W. Donald Duckworth, Hugh H. Genoways, and Carolyn L. Rose. 1993; 140 pp.

\$8 postpaid. Heritage Preservation, 1730 K Street NW, Suite 566, Washington, DC 20006. 888/388-6789, 202/634-1422, lkurtz@heritagepreservation.org, www.heritagepreservation.org.

The starting point for anybody with any interest in the care, maintenance, and preservation of natural history collections. A beautifully executed and thoughtful document. You ask the question, it points you to the best wisdom. —PW



FROM PRESERVING NATURAL SCIENCE COLLECTIONS

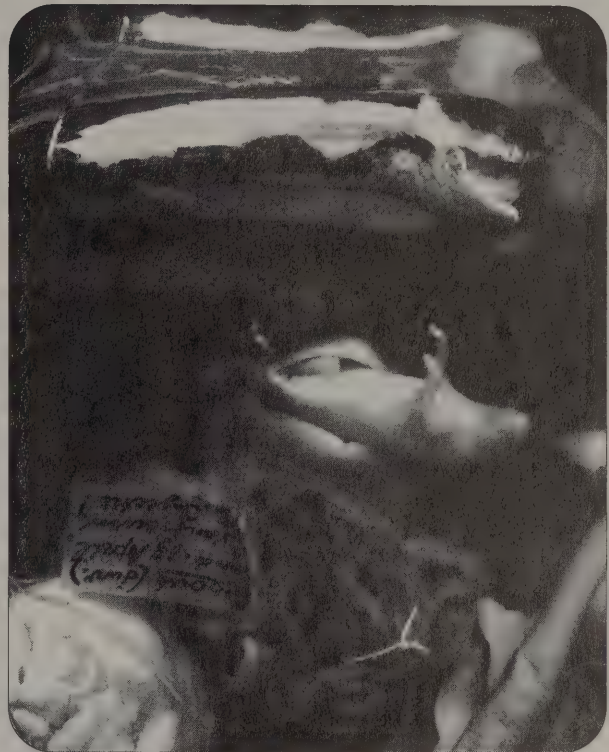
A TAXONOMIST'S TAXONOMIST

by Stephen Jay Gould
Photographs by Rosamond Wolff Purcell

We taxonomists and natural historians are said to be the fuddy-duddies and accountants of science—maintainers of the lists and guardians of the storehouses. The haughty princes of more prestigious disciplines have often used this image to lord their status over us. The physicist Lord Rutherford, at the turn of the century, called us glorified stamp collectors. His equally exalted successor Luis Alvarez, angered that many dinosaur taxonomists had disputed his asteroidal impact theory of mass extinction, used the same image just three or four years ago: “I don’t like to say bad things about paleontologists, but they’re really not very good scientists. They’re more like stamp collectors.” (I happen to agree with Luis on the extinction issue, but I deplore his simile. I might also say that, as a former philatelist, I reject his disparagement from both sides.)

Three supposedly common elements fuel this persistent simile: (1) the need to “get ‘em all,” to fill all the spaces in the album, or check off all the bird species on your life list; (2) the obsession with measurement of trivial differences and the need to collect all versions (every variation in number of perforations—philatelists have “perforation gauges” for quick and accurate counting—or each nuance in number and shade of tail feathers or body scales; (3) order, order, order.

Stereotypes, clichés and canonical legends often arise from substrates of validity, whatever their simplistic exaggerations or unfair mockeries. Amidst the variety of natural historians, we do find a small genre of blitzkrieg collectors and hoarders who can turn a species or habitat into the equivalent of the martyred Vietnamese village described in the infamous words of an American military commander: “We had to destroy the town in order to save it.” I study a West Indian land snail named *Cerion*. One of my predecessors, a manic collector who worked half a century ago, gathered *Cerion* by the tens of thousands (per site if available!). To this day his specimens remain in large burlap bags, never opened or studied, in drawers of the Smithsonian Institution. I cannot for the



life of me fathom what he thought he might ever do with so many shells. The science of statistics is dedicated to the proposition that you really don’t have to get them all.

In the true spirit of natural history—the cherishing of honorable diversity (both in objects and doers)—Rosamond Purcell and I present a fine collector who probably does come as close to the stereotype of “string not worth saving” as any taxonomists of note. Yet just as I once loved the triangular stamps of Tannu Tuva, ogled the reproduction of Goya’s naked *maja* on a Spanish issue, admired the colors of San Marino’s offerings to philatelists of the world (surely they were not meant for postage from this tiny principality), and tried to fill every Ceylonese space in my album—so too may we respect and appreciate the life and work of Willem Cornelis van Heurn (1887–1972).

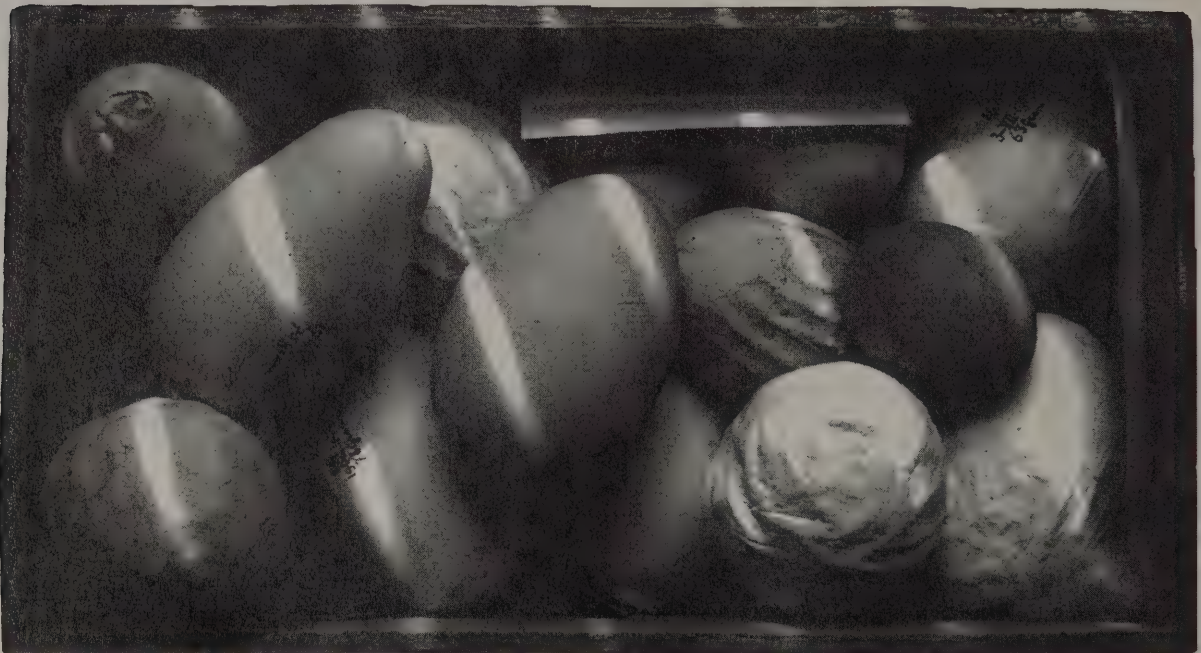
Van Heurn’s name will never loom large in the annals of science, for he spun no theories, invented no concepts, and coined no words. Among his hundred or so publications, the only item that even comes close to commenting on a conceptual issue in evolutionary theory appeared in 1955, under the

Above: Some of Willem van Heurn’s “uncurated miscellany,” including fetal pigs, snake, moles, mice, double apple, cat’s guts, slug, frog, toad.

EXCERPTED WITH PERMISSION FROM *FINDERS, KEEPERS: EIGHT COLLECTORS*, BY ROSAMOND WOLFF PURCELL AND STEPHEN JAY GOULD (SEE PAGE 55).

charmingly anthropocentric title: "Do tits lay eggs together as the result of a housing shortage?" As I scan his list of writings, I note (in abundance) all the staples of the stereotype—the endless descriptions and odd observations of a gentle, harmless, diligent naturalist, ever out for a new tidbit, a previously unnoticed grain of sand on nature's beach. "Poaching in the service of ornithology" in 1921. "A Gecko with a forked tail" and "Cannibalism in frogs" in 1928. "Mortality of chicken broods during a thunderstorm" in 1957. "Wrinkled eggs" in 1958. "Extra premolars in the lower jaw of the mole" in 1959. "Our cat washes herself" in 1962. Consider the totality of van Heurn's output for 1927: "Some comments on the bats of Buitenzorg," "The rat question," "Shark and ray leather," "The safety instinct in chick-

Taking full advantage of the limited Dutch empire, van Heurn went to Surinam in 1911, to Simaloer (an island off the west coast of Sumatra) in 1913, and to Dutch New Guinea in 1920–21. He then lived in the Dutch East Indies (mostly on Java) for fifteen years before returning to Holland in 1939. While in the Indies, he ran a laboratory for sea research, studied rat control on Java, Timor, and Flores, taught high school, and eventually became head of the botany department at the Netherlands Indies Medical School in Java. Everywhere he lived and travelled, van Heurn collected large series of specimens. These he would prepare and label in his particularly meticulous way. Most of this material ended up in the Leiden museum, where van Heurn himself worked as an assistant curator for fossil



Deformed eggs from van Heurn's collection.

ens," "An observation of a cuckoo which, without evidence, would have been falsely interpreted," and, finally, the ultimate exhortation of the careful collector, "Good labelling."

Van Heurn, endowed with advantages of high birth and family wealth, studied biology at the University of Leiden and remained an associate and benefactor of the Natural History Museum, one of the world's oldest and best, throughout his life. The memorial booklet by L.B. Holthuis and A.M. Husson, published by the Museum after van Heurn's death, succinctly stated his qualifications for his genre of science: "He made natural history collections wherever he went and gave his attention to almost all animal groups. He was an excellent shot, and a competent preparator; his mammal and bird skins are exemplary."

mammals from 1941 to 1945, before moving to Wilp in the central Netherlands. Van Heurn continued his collecting at Wilp, concentrating (as ever) on local natural history—in this case, the moles underground and domestic animals in plainer sight.

Rosamond Purcell's photographs beautifully capture the spirit (both strength and foibles) of natural history in this style. Consider the sheer number gathered of the most ordinary creatures, with each skin lovingly prepared and arranged in identical form and posture—above all, the plethora of moles, bodies flattened and forelegs splayed [page 55]. All prepared in exactly the same way, but collected to illustrate the differences among specimens that supply fuel to evolutionary change. (Van Heurn's two principal papers on moles treated variation in tooth number and coat color.) Do we not sense a paradox

here, in such procedural sameness and rigid formality applied to nature's bounteous diversity? Consider, too, the focus on ordering and labeling, especially in the frugal mode of the taxonomist with boxes of string not worth saving. Note the flattened rodent skin housed in the envelope—the original recipient dutifully crossed off and the proper Latin for the rat inserted [see Letters, page 100]. And the obsession with orderly measurement, whether or not any conceptual purpose be served.

But nature always wins in the end. You try, especially if a van Heurnian sense of tidiness be your temperament, to keep everything within proper categories and bounds (not to mention actual boxes). You even face nature's overt oddities with a drive to contain and classify (as in van Heurn's collection of

deformed eggs). But there is ultimately too much out there for one man, no matter how assiduous. Too much and too varied. Consider the "uncurated miscellany" [page 53]—including fetal pigs, snakes, moles, mice, cat's guts, a "Siamese twin" apple, slugs, frogs, and toads.

Van Heurn represents an extreme in our eclectic and aesthetic survey of collecting styles—the hyperacquisitive finder and meticulous keeper. This style is easy enough to criticize, particularly from a modern perspective that offers both moral and theoretical doubt—the former from "animal rights" ethicists, the latter from evolutionists and statisticians who know that good samples yield better conclusions than misguided attempts to bag the entirety (though the United States census, as constitu-

tionally mandated, is still trying to count each person, nose by nose, every ten years).

But we will speak for van Heurn and his way, however outdated. He was, first of all, a paragon of commitment, dedication, and knowledge. His colleagues honored this industry and expertise by naming more than forty taxa in his honor over a period of as many years. These species and subspecies, all given the trivial name *heurni* or *vanheurni* (though he also became godfather to the reptilian genus *Heurnia*), span the full range of his concerns from mammals to mollusks (with a mite and several insects in between). Secondly, his legendary courtesy and kindness also betoken a gentler, if less intellectually robust, style of science that did not run entirely on grant proposals and egotism.

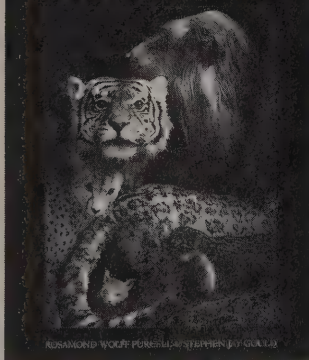
Nonetheless, I would base my major defense on an abstract principle, not on van Heurn's personal virtues. Nature's principal theme is infinite variety, both within the bounds of any species, and especially (and obviously) across the stunning range of form in any region or ecosystem. We, as primates evolutionarily committed to vision as a principal sense, comprehend this blooming and buzzing confusion by ordering and classifying, separating and comparing. Van Heurn's style represents a hypertrophy of this basic human instinct for comprehension. Can anyone gainsay the undeniable beauty of his myriad of moles, each rigidly wrought in identical style (the categorization that grants us comprehension), but each just a little bit different (the variety that nature poses both to and against our quest for understanding).

If we value the diversity of natural objects, then we must also cherish the varieties of honorable human behavior. Van Heurn undoubtedly could have found an appropriate pigeonhole for his own peculiarities. Picture him then in this little niche, as the objects of his lifelong passion look upon him, and intone Antony's final assessment of Brutus: "Nature might stand up and say to all the world, 'This was a man!'"



Background: some of van Heurn's "plethora" of European moles.

FINDERS, KEEPERS



FINDERS, KEEPERS Eight Collectors

Rosamond Wolff Purcell and
Stephen Jay Gould. 1992; 155 pp.
\$50. W.W. Norton.

This is the second collaborative book of Rosamond Purcell's crystalline, precise photography and Stephen Jay Gould's adventurous, encyclopedic natural history writing. Their third, *Crossing Over: Where Art and Science Meet*, is due in late fall from Three Rivers Press. It collects all their essays from *Harvard Magazine* and *The Sciences*. —MKS

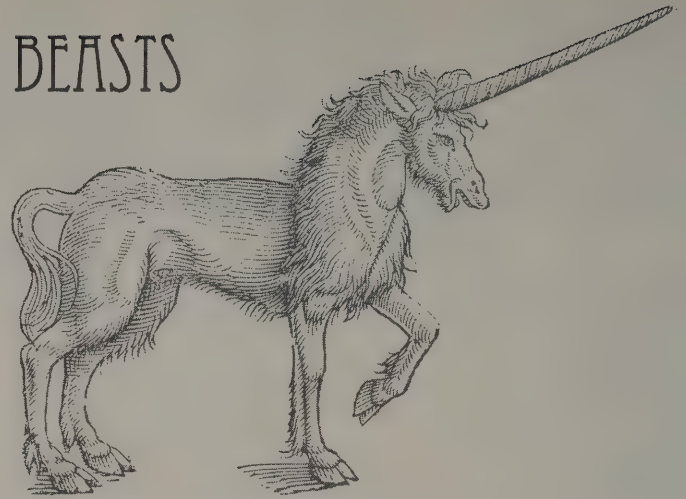
THE HISTORY OF FOUR-FOOTED BEASTS AND SERPENTS AND INSECTS

by Edward Topsell (1658)



Satyres :

Satyres are very seldom seen, and taken with great difficulty, for there were two of those found in the Woods, the female whereof was killed by the darts of the hunters, and the biting Dogs, but the male was taken alive, being in the upper parts like a Man, and in the neather part like a Goat, but all hairy throughout; he was brought to be tame, and learned to go upright, and also to speak some words, but with a voice like a Goat, and without all reason: he was exceeding lustful to women.



The Unicorn :

By the Unicorn we do understand a peculiar beast, which hath naturally but one horn, and that a very rich one, that groweth out of the middle of the forehead. The Arcean Indians do hunt a certain wild beast which is very curst, untamable, having one horn, which in the head, resembleth a Hart, in the feet an Elephant, in the tail a Boar, and in the residue of the body a Horse; the horn is about two cubits long, and the voice like the lowing of an Ox.

Sphinx :

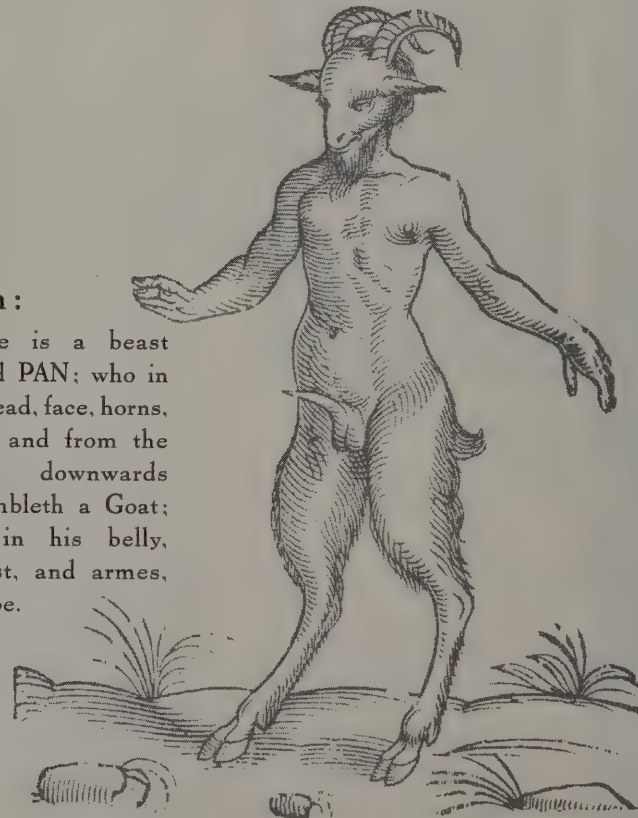
The Sphinx or Sphinga is of the kind of Apes, having his body rough like Apes, but his breast up to his neck, pilde and smooth without hair: the face is very round, yet sharp and piked, having the breasts of women, and their favour or visage much like them. In that part of their body which is bare without hair, there is a certain red thing rising in a round circle like Millet feed, which giveth great grace and comliness to their colour, which in the

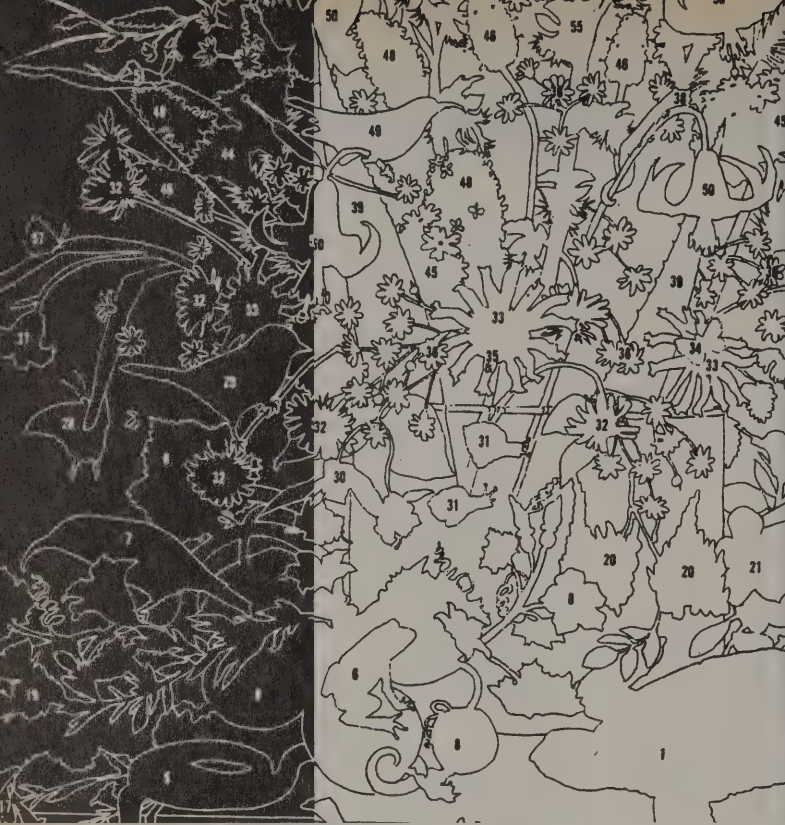


middle part is humane. Their voice is very much like a mans but not articulate, sounding as if one did speak hastily with indignation or sorrow. They are bred in India and Ethiopia. They carry their meat in the storehouses of their own chaps or cheeks, taking it forth when they are hungry.

Pan :

There is a beast called PAN; who in his head, face, horns, legs, and from the loins downwards resembleth a Goat; but in his belly, breast, and armes, an Ape.





FRONT COVER DETAIL: *DESCENDANT*, ISABELLA KIRKLAND (1999).



BACK COVER DETAIL: *ASCENDANT*, ISABELLA KIRKLAND (2000).

FOR THE COMPLETE PICTOGRAPH KEYS TO ALL THE LIFE-FORMS IN ISABELLA'S PAINTINGS, PLEASE SEND US \$5 TO COVER POSTAGE AND REPRODUCTION. WRITE "SPECIES" ON ENVELOPE.

The story of species is the story of change, played out through an intense, diffuse drama of interaction. Creatures, plants, parasites, etc. are all stepping on and bolstering each other, and their shared habitats are simultaneously constraining or releasing everybody's opportunities, *And* those habitats are largely made up of the very interactions they contain.

Some species lose, some win. Isabella Kirkland's remarkable paintings reflect the current state of play. With rare objectivity, *Descendant* shows a bouquet of sixty-one species described as "descendant" (i.e., endangered); *Ascendant* hands us an equally beautiful bouquet of sixty-six "ascendant" (usually described as "invader" or "weed") species. The ring-billed gull is busy winning these days, and the golden-cheeked warbler is busy losing. Fade up background music of the old disco tune—"Ah, ah, ah, ah. Stayin' alive. Stayin' alive."

Is there a "so what"? These paintings, which are on exhibit at Harvard's Museum of Comparative Zoology from September, 2000 to January, 2001, give pleasure by putting species endangerment into perspective. We get to revisit why we care. 1) Winning is always temporary; extinction always permanent—that ratchet forces our attention toward the extinction side. 2) These particular winners are

major displacers; when they arrive, other species disappear, often resulting in net impoverishment of local biocomplexity. 3) The current high rate of displacement and extinction is our doing. We're the ones disrupting habitat so much that "weed" species get the advantage; we're the ones globalizing species dispersal, to the great advantage of invaders.

In *Ascendant*, where is the most displacing species of all, *Homo sapiens*? (A typical statistic: there were once ninety-nine species of land birds in the Hawaiian Islands; the arrival of Polynesians and then Europeans reduced that number to thirty-two, of which nineteen are approaching extinction.) The human in the picture is the one behind your eye.

The other human manifest in both paintings is the artist. Isabella Kirkland (a *CoEvolution Quarterly* staffer from 1976 to 1980) adopted the oil and varnish techniques of the old European masters, so that she could combine great permanence in the images with fine depiction of detail. The paintings are 3 feet by 4 feet, with each species portrayed life-size, yet they reward study with a magnifying glass—in fact study that close is needed to complete the "Where's Waldo?" game of finding every species in each painting. That's appropriate. Finding those species in the real world is even harder. The story of species is also a detective story. —Stewart Brand

WHOLE EARTH COVERS

ASCENDANT SPECIES LIST

- 1 Asian long-horned beetle
—*Anoplophora glabripennis*
- 2 Japanese beetle—*Popilla japonica*
- 3 European gypsy moth—*Lymantria dispar*
- 4 Neon tetra—*Hyphessobrycon innesi*
- 5 Killer bees—*Apis mellifera scutellata*
- 6 Chinese mantid—*Tenodera aridifolia*
- 7 Brown-headed cowbird—*Molothrus ater*
- 8 Yellow starthistle—*Centaurea solstitialis*
- 9 Rusty crayfish—*Orconectes rusticus*
- 10 African clawed frog—*Xenopus laevis*
- 11 Cane toad—*Bufo marinus*
- 12 Bullfrog—*Rana catesbeiana*
- 13 Musk thistle—*Carduus nutans*
- 14 Artichoke thistle—*Cynara cardunculus*
- 15 Purple loosestrife—*Lythrum salicaria*
- 16 Medusa head—*Taeniatherum caput medusae*
- 17 Cheat grass—*Bromus tectorum*
- 18 Vinca—*Vinca major*
- 19 English ivy—*Hedera helix*
- 20 Multi-flora—*Rosa multiflora*
- 21 Ring-billed gull—*Larus delawarensis*
- 22 Tamarisk—*Tamarix parviflora*
- 23 Nutria—*Myocastor coypus*
- 24 Strawberry—Monoculturalization
- 25 Corn—Bio-engineering
- 26 Water hyacinth—*Eichornia crassipes*
- 27 Pigeon—*Columba livia*
- 28 Jackson's chameleon—*Chamaeleo jacksoni jacksonii*
- 29 Rosy wolfsnail—*Englandina rosea*
- 30 Hydrilla—*Hydrilla verticillata*
- 31 Green crab—*Carcinus maenas*
- 32 Death cap—*Amanita phalloides*
- 33 Fescue—*Festuca arundinacea*
- 34 Chinese tallow—*Sapium sebiferum*
- 35 Zebra mussel—*Dreissena polymorpha*
- 36 Asiatic clam—*Corbicula fluminea*
- 37 Large mouth bass—*Micropterus salmoides*
- 38 Dandelion—*Taraxacum officinale*
- 39 Bachelor buttons—*Centaurea cyanus*
- 40 Ice plant—*Carpobrotus edulis*
- 41 Mongoose—*Herpestes auropunctatus*
- 42 Red-eared pond slider—*Chrysemys scripta*
- 43 Cat—*Felis domesticus*
- 44 Kudzu—*Pueraria lobata*
- 45 Miconia—*Miconia clavescens*
- 46 Norway rat—*Rattus norvegicus*
- 47 Mile-a-minute vine—*Polygonum perfoliatum*
- 48 Oriental bittersweet—*Celastrus orbiculatus*

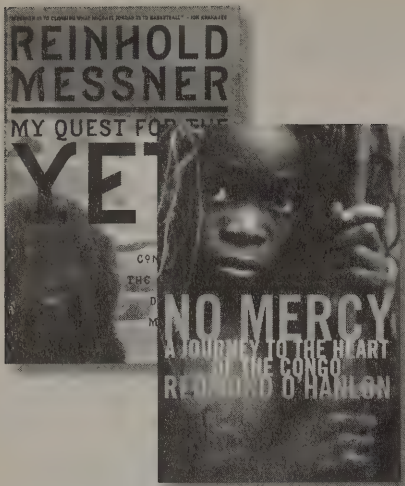
- 49 Cattle egret—*Bubulcus ibis*
- 50 Japanese knotweed—*Polygonum cuspidatum*
- 51 Sparrow—*Passer domesticus*
- 52 French broom—*Genista monspessulana*
- 53 Melaleuca—*Melaleuca quinquenervia*
- 54 Princess tree—*Pawlonia tomentosa*
- 55 Scotch broom—*Cytisus scoparius*
- 56 Arunda—*Arunda donax*
- 57 Starling—*Sturnus vulgaris*
- 58 Kahili ginger—*Heptachium gardnerianum*
- 59 Brown tree snake—*Boiga irregularis*
- 60 Jubata grass—*Cortaderia jubata*
- 61 Red-vented bulbul—*Pycnonotus cafer*
- 62 Brazilian pepper—*Schinus terebinthifolius*
- 63 Blue gum—*Eucalyptus globulus*
- 64 Baby's breath—*Gypsophila paniculata*
- 65 Common mullien—*Verbascum thapsus*
- 66 Fire ant—*Solenopsis invicta*

DESCENDANT SPECIES LIST

- 1 Hawksbill sea turtle—*Eretmochelys imbricata*
- 2 Condor egg—*Gymnogyps californianus*
- 3 Giant kangaroo rat—*Dipodomys ingens*
- 4 Little Kern golden trout—*Oncorhynchus aquabonita whitei*
- 5 San Francisco garter—*Thamnophis sirtalis tetrataenia*
- 6 Golden toad—*Bufo perigenus*
- 7 I'iwi—*Vestiaria coccinea*
- 8 Okeechobee gourd—*Cucurbita okeechobeensis*
- 9 Presidio manzanita—*Arctostaphylos hookeri*
- 10 James spiny mussel—*Pleuobema collina*
- 11 Fat pocketbook pearly mussel—*Potamilus capax*
- 12 Dwarf wedge mussel—*Alasmidonta heterodon*
- 13 Geysers panicum—*Dichanthelium lanuginosum v.thermale*
- 14 Valley oak—*Quercus lobata*
- 15 Guadalupe violet—*Viola guadalupensis*
- 16 Missouri bladderpod—*Lesquerella filiformis*
- 17 Indian Knob mountain balm—*Eriodictyon altissimum*
- 18 American burying beetle—*Nicrophorus americanus*
- 19 Vine hill clarkia—*Clarkia imbricata*
- 20 Price's potato bean—*Apios priceana*
- 21 Na'u—*Gardenia brighamii*
- 22 Valley elderberry longhorn beetle
—*Desmocerus californicus*
- 23 Baker's blennosperm—*Blennosperma bakeri*
- 24 Running buffalo clover—*Trifolium stoloniferum*
- 25 Myrtle silver spot—*Speyeria zerene myrtilae*

- 26 Laysan finch—*Telespiza cantans*
- 27 Striped adobe lily—*Fritillaria striata*
- 28 Schaus, swallowtail—*Heracles aristodemus ponceanus*
- 29 Golden-cheeked warbler—*Dendroica chrysoparia*
- 30 McFarlane's four o'clock—*Mirabilis macfarlanei*
- 31 Oahu tree snails—*Achatenella ssp.*
- 32 Ash meadows sunray—*Encilipsis nudicaulis v.corrugata*
- 33 Tennessee purple coneflower—*Echinacea tennesis*
- 34 Lotis blue—*Lycaeides argyrognomon lotis*
- 35 Hungerford's crawling water beetle
- 36 Scheinitz's sunflower—*Helianthus schweinitzu*
- 37 Shasta salamander—*Hydromantes shastae*
- 38 Desert slender salamander—*Batrachoseps aridus*
- 39 Arizona agave—*Agave arizonica*
- 40 Sensitive joint vetch—*Aeschynomene virginica*
- 41 San Clemente Island woodland star
—*Lithophragma maximum*
- 42 Strohbein's parnassian—*Parnassius clodius strohbeeni*
- 43 Black-capped vireo—*Vireo atricapillus*
- 44 Santa Ana woollystar—*Eriastrum densifolium ssp.sanctorum*
- 45 Large-fruited sand verbena—*Abronia macrocarps*
- 46 Swamp pink—*Helonias bullata*
- 47 Oblivious tiger beetle—*Cicindela latesignata obliviosa*
- 48 Contra Costa wallflower—*Erysimum capitatum v.angustatum*
- 49 Nuku pu'u—*Hemignathus lucidus*
- 50 Western lily—*Lilium occidentale*
- 51 Antioch shield-backed katydid—*Nebuda extincta*
- 52 Delta green ground beetle—*Elaphrus viridus*
- 53 Dehli sands flower-loving fly—*Rhaphiomidas terminatus abdominalis*
- 54 Western fringed prairie orchid—*Platanthera praeclara*
- 55 Eastern fringed prairie orchid—*Platanthera leucophaea*
- 56 White sedge—*Cyperaceae albida*
- 57 El Segundo blue—*Euphilotes battooides allyni*
- 58 Mission blue—*Icaricia icarioides missionensis*
- 59 'Akepa—*Loxops coccineus*
- 60 San Francisco fork-tailed damsel fly
—*Ischnura gemina*
- 61 San Bruno elfin—*Incisalia mossii bayensis*

Bolded names are shown on detail pictographs, facing page.



MY QUEST FOR THE YETI
 Confronting the Himalayas' Deepest
 Mystery
 Reinhold Messner. 2000; 165 pp. \$23.95.
 St. Martin's Press.

NO MERCY
 A Journey to the Heart of the Congo
 Redmond O'Hanlon. 1998; 462 pp. \$14.
 Vintage. (Suggested by Stefan Gutermuth.)

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We've emphasized the little guys through-
 out this issue—doing a little PR for the
 prokaryotes. But there's still the bring-'em-
 back-alive school looking for brontosaurus in
 remote Congo lakes, yetis wandering the
 Himalayas, marsupial tigers in Queensland,
 Sasquatch, the Loch Ness monster, whomev-
 er. Yeti and *No Mercy* are two of Stefan's
 recent favorites of, some would say, whimsi-
 cal maniacal naturalists. Messner comes to
 accept the old theory that the yeti is really a
 bear. He'll never convince the true believers,

but the search makes for enthralled adven-
 ture. O'Hanlon is a romping fun writer in pur-
 suit of the brontosaurus, though you get much
 more misadventure than dinosaur. Dwarf
 crocs, giant eagles...probably the best por-
 trait of contemporary Congo madness. The
 Cryptozoologists track it all. —PW

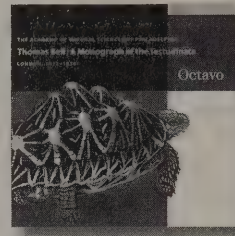
“ In 1960, Sir Edmund Hillary
 himself led an expedition to the borders
 of Nepal and Tibet, in search of the
 yeti....The expedition carried state-of-the-
 art equipment for scientific analysis, as
 well as an official Nepalese government
 decree prohibiting the capture or killing of
 a yeti, should one be found. But none were
 found.

Hillary's expedition did bring back
 furs that supposedly came from yetis, and
 an abundance of photos of suspicious
 tracks in the snow. They also managed to
 borrow the legendary “yeti scalp,” a relic
 housed in the Sherpa monastery in
 Khumjung. The furs turned out to be
 from Tibetan bears. And the scalp, a
 stone-hard leather cap with bristles, was
 put under microscopes in laboratories in
 Chicago, Paris, and London, and proved to
 be made from the skin of a two-hun-
 dred-year-old wild Himalayan goat.
 —MY QUEST FOR THE YETI

“ As I fell asleep I wondered if
 we'd see any of the special animals that
 Bahuchet lists, the taboo animals that no
 pygmy mother or father—from the first
 signs of pregnancy to the child's first
 steps—must eat....Or perhaps we'd flush
 one of the forbidden animals that live in
 holes underground. A Giant pangolin or
 an armadillo. Or catch a glimpse of some-
 thing altogether too close to the world of
 ghosts, half-animal, half-bird, the Flying
 squirrel?...But most of all I wanted to see
 one of the final category of proscribed
 animals (those, like Lary and me, and
 many monkeys and small antelope, with



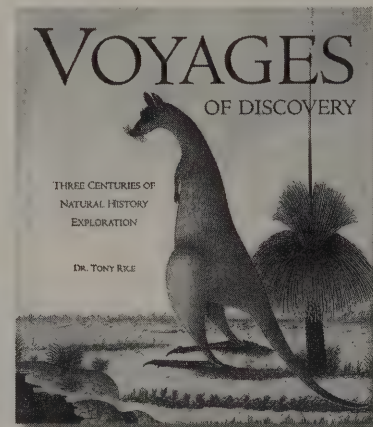
white, the colour of the spirits, on their
 faces): the Bongo, the largest known for-
 est antelope....It was the Bongo that
 jumped the nets, jinked brown and white
 through the back-curved barbs of flying
 spears, and outran the poison ends of air-
 borne pencils through my dreams.
 —NO MERCY



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 borders on the surreal, with cartooning and
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 editions include William Harvey, Newton, and
 Vesalius, with more on the way. —PW



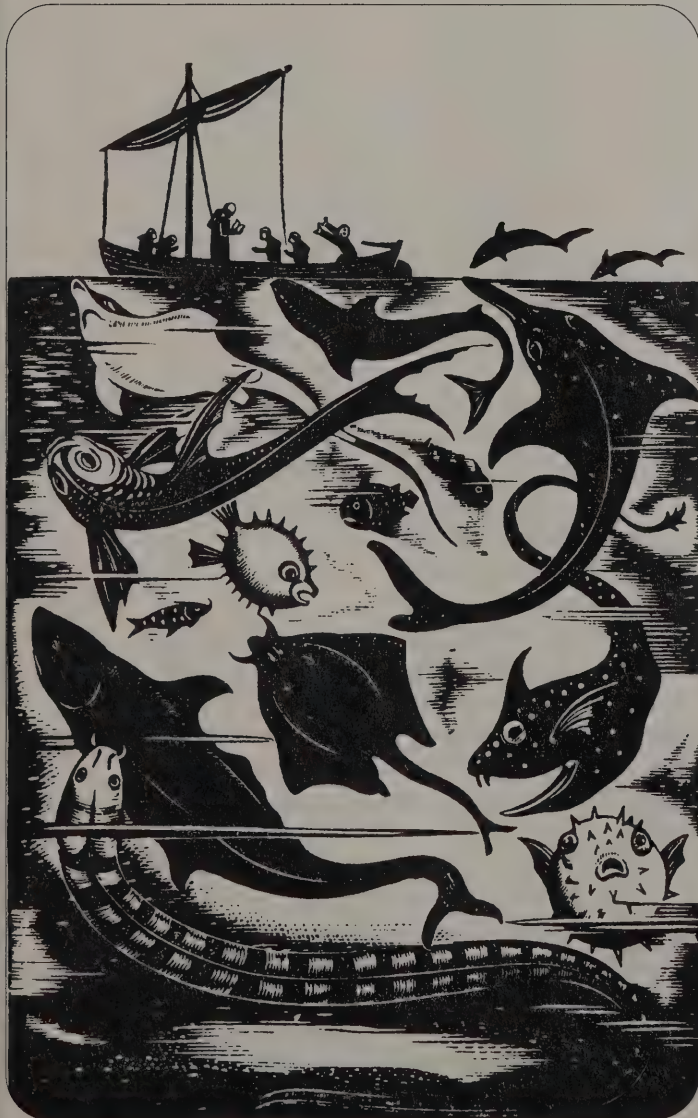
VOYAGES OF DISCOVERY
 Three Centuries of Natural History
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 Tony Rice. 1999; 335 pp. \$60. Clarkson
 Potter.

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 choices and reproductions of art, and simply
 told stories of major explorer-naturalists. —PW

Life Is A Miracle

Never forget: We are alive within mysteries

by Wendell Berry



I am not at all a scientist. And yet, like every human inhabitant of the modern world, I have experienced many of the effects (costs and benefits) of science; I have received a great deal of hearsay of it; and I know that I am always under its influence and mercy. Though I am unable to comment on its methods or the truth of its discoveries, I am nonetheless appropriately interested in its motives—in what it thinks it is doing and how it justifies itself. I agree with the proposition that science (or “science-and-technology”) has become a sort of religion. I want to know by what power it has crowned itself and mitered itself.

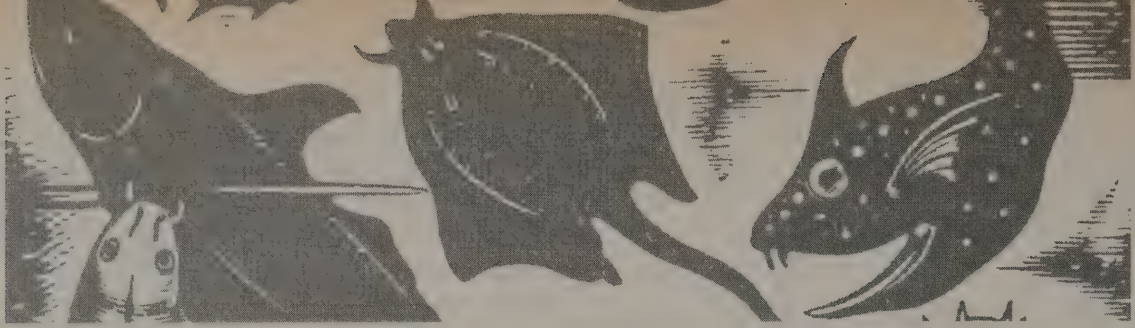
Reductionism (ultimately, the empirical explainability of everything and a cornerstone of science), has uses that are appropriate, and it also can be used inappropriately. It is appropriately used as a way (one way) of understanding what is empirically known or empirically knowable. When it becomes merely an intellectual “position” confronting what is not empirically known or knowable, then it becomes very quickly absurd, and also grossly desensitizing and false.

There obviously is a necessary usefulness in the processes of reduction. They are indispensable to scientists—and to the rest of us as well. It is valuable (sometimes) to know the parts of a thing and how they are joined together, to know what things do and do not have in common, and to know the laws or principles by which things cohere, live, and act. Such inquiries are native to human thought and work.

But reductionism also has one inherent limitation that is paramount, and that is abstraction: its tendency to allow the particular to be absorbed or obscured by the general. It is a curious paradox of science that its empirical knowledge of the material world gives rise to abstractions such as statistical averages which have no materiality and exist only as ideas. There is, empirically speaking, no average and no type. Between the species and the specimen the creature itself, the individual creature, is lost. Having been classified, dissected, and explained, the creature has disappeared into its class, anatomy, and explanation. The tendency is to equate the creature (or its habitat) with one’s formalized knowledge of it.

The uniqueness of an individual creature is inherent, not in its physical or behavioral anomalies, but in its *life*. Its life is not its “life history,” the typical cycle of members of its species from conception to reproduction to death. Its life is all that happens to it in its place. Its wholeness is inherent in its life, not in its physiology or biology. This wholeness of creatures and places together is never going to be

Left: St. Brendan and his men celebrating the Feast of St. Paul in a boat on the Irish sea. They are followed by innumerable fishes “such as never were discovered to human eye before.” Woodcut by R. Gibbings, 1934.



apparent to an intelligence coldly determined to be empirical or objective. It shows itself to affection and familiarity.

The frequent insultingness of modern (scientific-technological-industrial) medicine is precisely its inclination to regard individual patients apart from their lives, as representatives or specimens of their age, sex, pathology, economic status, or some other category. The specialist to whom you have been “referred” may never have seen you before, may know nothing about you, and may never see you again, and yet he (or she) presumes to know exactly what is wrong with you.

Science speaks properly a language of abstraction and abstract categories when it is properly trying to sort out and put in order the things it knows. But it often assumes improperly that it has said—or known—enough when it has spoken of “the cell” or “the organism,” “the genome” or “the ecosystem” and given the correct scientific classification and name. Carried too far, this is a language of false specification and pretentious exactitude, never escaping either abstraction or the cold-heartedness of abstraction.

The giveaway is that even scientists do not speak of their loved ones in categorical terms as “a woman,” “a man,” “a child,” or “a case.” Affection requires us to break out of the abstractions, the categories, and confront the creature itself in its life in its place. The importance of this for conservation can hardly be overstated. For things cannot survive as categories but only as individual creatures living uniquely where they live.

We know enough of our own history by now to be aware that people *exploit* what they have merely concluded to be of value, but they *defend* what they love. To defend what we love we need a particularizing language, for we love what we particularly know. The abstract, “objective,” impersonal, dispassionate language of science can, in fact, help us to know certain things, and to know some things with certainty. It can help us, for instance, to know the value of species and of species diversity. But it cannot replace, and it cannot become, the language of familiarity, reverence, and affection by which things of value ultimately are protected.

Directly opposed to this reduction of abstraction of things is the idea of the preciousness of individual lives and places. This does not come from science, but from our cultural and religious traditions. It is not derived, and it is not derivable, from any notion of egalitarianism. If all are equal, none can be precious. (And perhaps it is necessary to stop here to say that this ancient delight in the individuality of creatures is not the same thing as what we now mean by “individualism.” It is the opposite. Individualism, in present practice, refers to the supposed “right” of an individual to act alone, in disregard of other individuals.)

We now have the phenomenon of “mitigation banking” by which a developer may purchase the “right” to spoil one place by preserving another. Science can measure and balance acreages in this way just as cold-heartedly as commerce; developers involved in such trading undoubtedly have the assistance of ecologists. Nothing insists that one place is not interchangeable with another except affection. If the people who live in such places and love them cannot protect them, nobody can.

It is not quite imaginable that people will exert themselves greatly to defend creatures and places that they have dispassionately studied. It is altogether imaginable that they will greatly exert themselves to defend creatures and places that they have involved in their lives and invested their lives in—and of course I know that many scientists make this sort of commitment.

I have been working this morning in front of a window where I have been at work on many mornings for thirty-seven years. Though I have been busy, today as always I have been aware of what has been happening beyond the window. The ground is whitened by patches of melting snow. The river, swollen with the runoff, is swift and muddy. I saw four wood ducks riding the current, apparently for fun. A great blue heron was fishing, standing in water up to his belly feathers. Through binoculars I saw him stoop forward, catch, and swallow a fish. At the feeder on the window sill, goldfinches, titmice, chickadees, nuthatches, and cardinals have been busy at a heap of free (to them) sunflower seeds. A flock of crows has found something newsworthy in


For things
cannot survive as
categories but only as
individual creatures
living uniquely
where they live.

the cornfield across the river. The woodpeckers are at work, and so are the squirrels. Sometimes from this outlook I have seen wonders: deer swimming across, wild turkeys feeding, a pair of newly fledged owls, otters at play, a coyote taking a stroll, a hummingbird feeding her young, a peregrine falcon eating a snake. When the trees are not in leaf, I can see the wooded slopes on both sides of the valley. I have known this place all my life. I long to protect it and the creatures who belong to it. During the thirty-seven years I have been at work here, I have been thinking a good part of the time about how to protect it. This is a small, fragile place, a slender strip of woodland between the river and the road. I know that in two hours a bulldozer could make it unrecognizable to me, and perfectly recognizable to every “developer.”

The one thing that I know above all is that even to hope to protect it, I have got to break out of all the categories and confront it as it is; I must be present in its presence. I know at least some of the categories and value them and have found them useful. But here I am in my life, and I know I am not here as a representative white male American human, nor are the birds and animals and plants here as representatives of their sex or species. We all have our ways, forms, and habits. We all are what we are partly because we are here and not in another place. Some of us are mobile; some of us (such as the trees) have to be content merely to be flexible. All of us who are mobile are required by happenstance and circumstance and accident to make choices that are not instinctive, and that force us out of categories into our lives here and now. Even the trees are under this particularizing influence of place and time. Each one, responding to happenstance and circumstance and accident, has assumed a shape not quite like that of any other tree of its kind. The trees stand rooted in their mysteriously determined

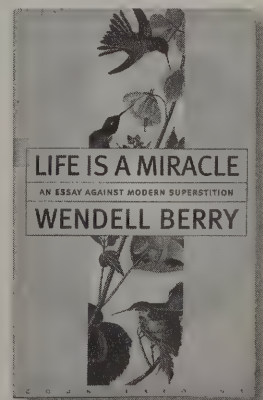
places, no place quite like any other, in strange finality. The birds and animals have their nests in holes and burrows and crotches, each one's place a little unlike any other in the world—and so is the nest my mate and I have made.

In all of the thirty-seven years I have worked here, I have been trying to learn a language particular enough to speak of this place as it is and of my being here as I am. My success, as I well know, has been poor enough, and yet I am glad of the effort, for it has helped me to make, and to remember always, the distinction between reduction and the thing reduced. I know the usefulness of reductive language. To know that I am “a white male American human,” that a red bird with black wings is “a scarlet tanager,” that a tree with white bark is “a sycamore,” that this is “a riparian plant community”—all that is helpful to a necessary kind of thought. But when I try to make my language more particular, I see that the life of this place is always emerging beyond expectation or prediction or typicality, that it is unique, given to the world minute by minute, only once, never to be repeated. And that is when I see that this life is a miracle, absolutely worth having, absolutely worth saving.

We are alive within mystery, by miracle. “Life,” wrote Erwin Chargaff, “is the continual intervention of the inexplicable.” We have more than we can know. We know more than we can say. The constructions of language (which is to say the constructions of thought) are formed within experience, not the other way around. Finally we live beyond words, as also we live beyond computation and beyond theory. There is no reason whatever to assume that the languages of science are less limited than other languages. Perhaps we should wish that after the processes of reduction, scientists would return, not to the processes of synthesis and integration, but to the world of our creatureliness and affection, our joy and grief, that precedes and (so far) survives all of our processes. 

Wendell Berry has contributed to all incarnations of *Whole Earth* for two decades. We find him the great subversive, the straight talker who disarms the urban sophisticate. From *The Unsettling of America* to *A Timbered Choir*, his latest book of poems, he has offered up sharp Montaigne-like essays and poems of tilt and reverence.

Excerpted from *Life is a Miracle: An Essay Against Modern Superstition* (Wendell Berry, 2000; 153 pp. \$21. Counterpoint). Used with permission.



HAWAII

THE BIOREGION

A LETTER ABOUT "ALOHA," THE INTERNAL PARADISE

BY LANAKILA BRANDT

I have, over the years, received many requests for "a definition of 'aloha,'" or words to that effect. And, though I have such facile "definitions" at my fingertips, most are merely clichés, failing to touch completely the inner expression of so beautiful a word.

I was nudged into this train of thought by a letter from a Maui friend, author Georgia Tanner, who invited me to state my mana'o "about the meanings of this complex and important word," which, in the same sentence, she so sensitively perceived as "that internal paradise, the spirit of aloha."

And it really is just that, isn't it; not just the shop-worn Hawaii Visitors Bureau promotional gimmick, the tour guide's plastic smile with palm extended, nor the hula show emcee's hokey "Alooo-Ha!" which convey absolutely nothing of the true spirit of Hawaii—they just mean, "We hope you brought your money!" Aloha is a meaningful expression of the spirit. And although the word is Hawaiian, its message is universal...love, enriched by tenderness, compassion, consideration, charity, and understanding.

Aloha is all of the foregoing, and much more. To me, aloha is that innate quality which permits, us, whatever our circumstances, to revel in the inalienable wealth with which our benevolent gods have endowed us; to luxuriate in the heady fragrance of lush mountain groves as we chant paeans of love to "Earth Mother" Haumea while harvesting fragrant



Bodysurfers in Makapu'u, O'ahu. Photo by Wayne Levin from *Through A Liquid Mirror* (see opposite page).

ferns, lichens, and sweet maile vines to adorn the hula altar of divine Laka.

It is communicating with, and receiving inner guidance from, the Earth, the sea, the winds and the sky, from the creatures that swim, crawl, and walk. It is treading precipitous and often bizarre lava footpaths down into the fiery heart of Pele's Kilauea home—to dance and chant and lay our humble nature offerings upon the molten robes of our adored fire goddess.

Aloha, for me, is sharing the deep knowledge of our Hawaiian ancestors with the truly dedicated tide of Seekers whose mystic helmsman guides them to our beacon light each year. It is sharing with the many the enchanting public presence, lovingly honed skills, and the passionate spiritual expression of my sacred dancers, the women of my halau hula.

And they, realising that, perhaps, not one word of the melodious chants they sing may be understood by the mass of those who listen entranced...*know* that it is not important: the gods hear and understand. And for Tanata, "Man,"...the urgent message of the spirit touches the greatest and the least, equally and impartially—and all are enriched, both those who give and those who receive. And, when I raise my arms and cry the gods, I am lifted. I am endowed—for that fleeting moment—I and we are permitted to be one with Them: Aloha...

Aloha is my children, and my grandchildren, the fruit and essence of my being who, with other scores of budding "flowers" have shyly entered my world of the spirit and the dance—to learn, and take honest pride in, the noble creative traditions of our common ancestors. This fulfillment is also aloha.

Aloha is the women who have been my wives and lovers, my creative partners and my inspiration. And I love each of them still—for the shared gifts

of love and faith; for providing both vehicle and stage for my own unfolding; for permitting me to guide them in theirs; for loving gifts of mana.

Aloha is "a complex and important word" of near unlimited powers. But its greatest power and beauty is that, by whatever name, we all have it! We need only to open the floodgates and let it flow; let it inundate all within our individual spheres. Then truly will each of us be living within "that internal paradise, the spirit of Aloha."

I mahalo Georgia for asking the question and again for providing her profoundly lovely answer; and lastly, for nudging me to set forth my own simple thoughts and feelings about ...*aloha*. I don't believe my rambling summation really covers the definition you came seeking, yet it is me, and I can offer nothing more...

ALOHA.

Lanakila's father was Austrian and his mother Portuguese/Hawaiian. He was "given" to his grandparents for instruction. He has a Doctor of Divinity and is well versed in the secular ancient hula. He is a kahuna ("priest") at one of the few active Hawaiian temples



Healer/priest Lanakila Brandt praying.

(Pu'uhonua O Hōnaunau) formerly known as the City of Refuge. He is founder of Kahanahou Hawaiian Foundation, PO Box 1639, Kealahou, HI 96750. 808/322-3901, dedicated to the perpetuation of ancestral traditions.

THE HEARTBEAT OF KA PAE'AINA Compiled by Emily Polk, with thanks to Bill Taylor

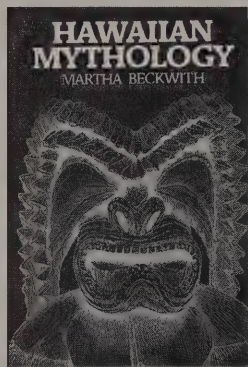
VOICES OF WISDOM
Hawaiian Elders Speak
MJ Harden and Steve Brinkman. 1999; 239 pp.
\$24.95. AKA Press, 808/878-2126, mjh@maui.net.

Collected from twenty-four elderly voices of Hawaiian healers, hula masters, artists, teachers, farmers, wood carvers. Deep connections to Earth, nature, spirit.

CHANGE WE MUST
My Spiritual Journey
Nana Veary. 1989; 119 pp.
\$16.95. Institute of Zen Studies, imservices.com/zenbookstore.

A modern-day monk, Nora Veary shares the story of her life in Hawai'i, and how she got so wise. A poignant meditation.

HAWAIIAN MYTHOLOGY
Martha Warren Beckwith. 1977; 606 pp. \$16.95. University of Hawaii Press.



One of the first books to translate ancient oral folklore, legend, and myth into readable, fascinating stories about the ancestral gods of Hawai'i. A classic.

WWW.OLELO.HAWAII.EDU

A bilingual site designed by University of Hawai'i at Hilo to help preserve Hawaiian-speaking communities around the world. Resources for people interested in learning Hawaiian.

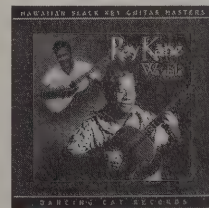
NEW POCKET HAWAIIAN DICTIONARY
Mary Kawena Pukui and Samuel H. Elbert, eds. 1992; 256 pp. \$4.95. University of Hawaii Press.

If you think *aloha* is a beautiful word, here are 10,800 more. Useful for everyday speech, names of plants and animals, and pronunciation.



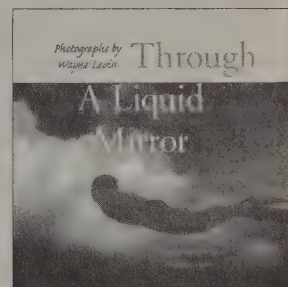
IZ: IN CONCERT
The Man and His Music (CD)
Israel Kamakawiwo'ole. 1998. \$22.99. Mountain Apple Company, P.O. Box 22373, Honolulu, HI 96823. 800/882-7088.

If sunsets had background music, the voice and ukulele of Israel Kamakawiwo'ole would be it. He is more than Hawai'i's most famous musician. He is its soul as well.



RAY KĀNE
Wa'ahila (CD)
Ray Kane. 1998. \$16.97. Dancing Cat Records. BMG Entertainment, 1540 Broadway, New York, NY 10036-4098.

Hawai'i's legendary slack key guitar master is still playing the way he learned as a child over sixty years ago. Fourteen tunes include vocal duets with his wife.



THROUGH A LIQUID MIRROR
Photographs by Wayne Levin
Wayne Levin. 1997; 102 pp. \$25. Editions Limited.

Levin's photos of underwater landscapes are so surreal, you can almost hear them. Taken in waters off the Hawaiian Islands, Costa Rica, and Micronesia.

WWW.HAWAII-MUSIC.COM

Master index of Hawaiian music on the Web. Great links to Hawai'i's top music sites.

THE UNADULTERATED

ALOHA TOUR

Beyond "Paradise" and "Melting Pots"

by Pamela Frierson

Excerpted with permission from "Visions of Paradise," in *Discovery: The Hawaiian Odyssey*, Eric Herter, ed. Bishop Museum Press, 1993.



Left to Right:
Rebecca
(German,
Portuguese,
Irish, Welsh);
Haley
(Filipino,
English,
Chinese, Irish,
Spanish);
Leslie
(Chinese,
Okinawan,
English,
Hawaiian).

PHOTO FROM
Rainbow Kids
(SEE PAGE 68).

One dream seems common to all people: the dream of an idyllic place, of a region of peace and harmony, ease and delight. In some cultures it is the realm of spirit; in others it is real, earthly, but difficult to find. In human settlements with a view toward where the sea meets the sky this vision of a blissful place most often takes the form of an island. What is it the sight of an island awakens in us? Recently I was visiting the Windward

coast of O'ahu and I dragged a kayak over the sand to the water and paddled out toward the horizon. Then I turned and drifted awhile, looking at the island. Above Waimanalo, the sultry, windless air had piled clouds and mist, smoky gray against the dark ramparts of the Ko'olau range. Below those shrouded cliffs, green-black thickets of ironwood lined the shore, and, at the edge of this sombre landscape, the sunshine broke through to illuminate a dazzling strip of beach. That thin line of bright shore seemed to promise everything, and I won-

dered if the magic of the islands wasn't contained there, in that narrow border between land and sea. Perhaps it pulls from all of us the same deep memory: the moment we were born from a water-life into luminous air, cast from an amniotic sea onto a light-flooded shore.

It may be for this reason that the dream of islands condenses into a compelling yearning for safe harbor, for childlike bliss, and into one simple image: a beautiful beach (add a coconut tree or two for shade).

In Hawai'i the dream takes on a particular configuration: paradise. It is a term so freely applied here that we never seem to question what it means. On the island where I live, the "Big Island" of Hawai'i, one can visit Paradise Found Boutique, Paradise Realty, Paradise Plumbing, or twenty-three other businesses whose names begin with the word. There is even a Paradise Avenue, a potholed stretch of asphalt that runs through a subdivision built on startlingly recent lava flow.

What is paradise then? The Hawaiian visitor industry seems to know and has offered its view of paradise quite consistently since the turn of the century, in a tangled bouquet of truths, half-truths and total fabrications. (In my favorite Matson Ocean Liner menu illustration from the forties, the portrait of a "native" lu'au, the Hawaiians resemble Italians, the flowers look like Shasta daisies, and out of an enormous net full of cascading fruit the only one ancient Hawaiians would have recognized is the banana. But why quibble at a portrait so endowed with the "aloha spirit," for everyone is bright eyed and smiling, including the pig fresh from the imu...).

But is it possible that we who have been here a long time, who may even have native blood in our veins, sometimes confuse image with reality? Is this one powerful reason we too have been slow to recognize and cherish the fragile uniqueness of our island environment, slow to protect and foster Hawai'i, the real place? While we offer a generic Polynesian experience to the world, our own native biota is dying off at a rate unprecedented anywhere. While we offer the ubiquitous aloha greeting, the lei of nonnative flowers, the real issues of Hawaiian cultural survival largely go ignored. Have we become lost in the dream kingdom we helped to build?

This is not to say that dreaming itself is at fault; the Polynesian voyagers who discovered these islands no doubt bore with them their vision of an ideal place. Throughout the Pacific one finds the belief in far-off lands, ancient ancestral homes or spirit worlds. Often, the name given is Hawai'i, or Hava-iki. In numerous legends these places are floating islands, situated below the earth or above, in the clouds, or just beyond the horizon. In Polynesian myth, longings seem to take the shape of more or better than what one already has.

In Western tradition, however, such visions seem to spring from a profound discontent. Western history gives us a great array of visions of paradise, from sensuous pagan to idealized Christian, from "blessed isles," such as the Hesperides, home of golden apples, to Elysian fields, from the Garden of Eden to the Big Rock Candy Mountain. The extent to which Western culture has viewed life as harsh and difficult can be measured, perhaps, in the depth of

longing for a far different world.

In fact, the dream had little to do with physical reality; its topography in the Western mind was shaped by two paradoxical urges—on one hand, a yearning for a lost purity, an Edenic ideal, on the other hand a fantasy of pleasures and treasures for the taking. The two conflicting desires, the one for an ideal harmony, and the other for gratification and freedom from constraint, are both part of the Western vision of paradise. That is why pilgrimage and plunder have been linked since way before the Crusades.

If we are to develop a more realistic sense of place we will need to strip the varnish from some cherished myths about our island world.

Each immigrant group must have had its dreams, a mingling of their own beliefs with the stories told to them about Hawai'i. In the Pure Land teachings of Buddhism, which the Japanese immigrants who came to Hawai'i would have known about, the compassionate deity Amida rules over the Western Paradise, a fabled world of luscious greenery, beautiful birdsong, crystalline waters dropping with sweet music over stones, and soft, flower-scented air. The word that reached the impoverished rural villages from which immigrants were drawn was that Hawai'i possessed some of these attributes, that humans and nature were more kindly there. In China, Hawai'i was known as "Tan Heung Shan," or the "Fragrant Sandalwood Hills." In the Azores, the Portuguese islanders talked of a beautiful island "Terra Nova." The Filipinos who recruited among their people declared that "Kaslo gloria ti Hawai'i": "Hawai'i is like a land of glory."

It was not the "aloha spirit" that motivated the leaders of Hawai'i to recruit immigrants. In 1825, the Hawaiian population was around 140,000, reduced by foreign diseases to less than one fourth of what it had been at the time of Cook's arrival less than fifty years earlier. By 1896 it was down to 39,504. Dying as a race was a very real and terrifying possibility, and

the Hawaiian willingness to assimilate and intermix with other races during this time has to be seen partly in that light. The specter of a shrinking population was as strong a catalyst as the search for a steady labor force. During Kalakaua's reign (1874-1891), the government spoke of importing "cognate" races to augment the native one. Several groups of Pacific islanders were brought in. A plan to import Asiatic Indians was considered but never came about, and the Japanese were finally persuaded to sign an emigration treaty with promises from Kalakaua's envoy that "Hawai'i holds out her loving hand and heart to Japan."

The plantation owners had very different reasons for mixing the races brought in. The planter strategy was to bring in new immigrants of a different race, to divide and conquer by developing an ethnically diverse stratified society. In many ways, plantation society determined the social and economic structure of modern Hawai'i. In their common struggle to better their lives on plantations, workers reached out to each other across racial boundaries. In the years that followed, they sacrificed much of their own cultural heritage in order to become full citizens of their new homeland. What traditions survived became mixed into the cultural chop suey we all delight in.

One of my favorite local scenes is the Hilo Farmer's Market. The market fills two vacant lots on the broad curve of the bay, sandwiched between old buildings and an increasing number of remodeled ones. Under the ubiquitous blue tarps (cheap roofing material of choice here in the Islands), blessed by Hilo's liquid sunshine, Japanese, Chinese, Koreans, Okinawans, Filipinos, Portuguese, Vietnamese, Hawaiians, and Caucasians, and various human blends, sell an astounding array of fruits, vegetables, and flowers. On one table, presided over by a handsome couple—Filipino-Chinese-Hawaiian-woman, Portuguese-Caucasian-Hawaiian man—are native 'oleña (turmeric) and various edible fern

shoots and taro, Chinese ginger and parsley, bok choy and wing beans, narrow Japanese eggplant, Chinese, Philippine, Brazilian and native varieties of banana, Indonesian seedless guava, Spanish cherimoya, Mexican sapodilla, local breadfruit, and Cuban soursop. The market is a bustling, cheerful scene: tables mobbed with



MAILE
COOK ISLANDS
MAORI,
ENGLISH,
UKRAINIAN,
MONGOLIAN,
TAHITIAN



MATTHEW
SAMOAN,
FRENCH,
ALGONQUIN



KRISTOIA
AFRICAN-
AMERICAN,
JAPANESE,
PORTUGUESE,
HAWAIIAN,
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KATHY
JAPANESE,
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PHOTOS FROM
RAINBOW KIDS.

people buying, asking for tips on how to prepare foods they have never tried before; tourists bemusedly trying to decipher pidgin replies. A well-seasoned ethnic stew.

With over 50 percent of marriages interracial, one could justifiably call Hawai'i the world's most successful multiethnic society. But one might argue that in the fiftieth state ethnic difference is more tolerated than cultural difference. The pressure to adopt mainstream American norms may be as great here as it is anywhere in the Union. The romantic vision of Hawai'i as "melting pot" sidesteps the question of how to preserve a truly vital multiethnic heritage. If the only real choice is to live like the rest of the Western world, then in fact "melting pot" is a euphemism for the process of losing one's own cultural inheritance.

"Melting pot" and "paradise" are related terms; each masks an agenda. I've spoken of the sailor's dream of a sensual idyll or the immigrant's dream of a land of plenty, but it was the Christian view, the missionary vision, which translated easily into a mandate to control Hawaiian destiny. In Christian tradition paradise is the place where humans succumbed to evil, the lush garden of forbidden fruit. If Hawaiians lived in an abundant Eden then it was Eden after the Fall, a place of spiritual darkness. "Wake, Isles of the South," trumpeted a hymn popular with missionaries called to Hawai'i, "No longer repose in the borders of gloom..."


Many of the missionaries who came to the Islands proved friends to the natives, learning the language and nursing those who fell ill. But they were carriers of an ethic that viewed Hawaiians as ignorant children living in a fallen Eden, a view easily reinterpreted as reason for colonialism. In 1893, when a handful of American business men forced the Hawaiian Queen Lili'uokalani to step down and installed their own provisional government, the words "mission" and

"manifest destiny" were used interchangeably in stateside news editorials. The mission, it seems, was to save the Hawaiians from themselves. As this bit of 1893 doggerel, published in Massachusetts as a "Valentine to Hawai'i" put it:

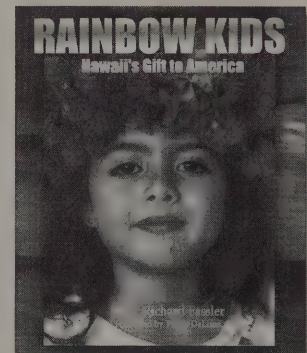
*You half-drowned chick in a waste of waters,
Poor motherless, fatherless thing,
Be one of Columbia's fair daughters,
And rest beneath her ample wing.*

Perhaps it's time for new visions to replace the familiar "melting pot" and "paradise"? Certainly we should not rely so heavily on the ways of the "Mainland," the *malihini* name we've adopted for that large continent to the east of us. We might see what we can learn from places that have more in common with us, in terms of environment and culture. In preserving our fragile native forests for example, we could take some cues from Costa Rica, a small, mountainous country with one of the best records for environmental protection of any place in the world. And certainly our Pacific neighbors, like the Cook Islanders, have skills to teach us about living in harmony with our fragile island world. But the fundamental resource for our voyage of self-discovery is the indigenous culture of these islands we now call Hawaiian—a culture that is in many ways the articulate soul of this place.

Sometimes, when I have visitors from the Continent, I take them on a *holoholo* I call the "Unadulterated Aloha Tour." We spend a few minutes inside a lava tube, in the pitch dark, listening to a primal silence. Then I lead them across some very clinkery 'a'a, the kind that can tear your shoes to shreds, to a remnant of an old stepping stone trail and the depressions and heaped stones that mark an ancient Hawaiian sweet potato garden. I tell them about ancient Hawaiian footwear (usually nothing, but occasionally sandals woven from *ti* leaves).

The next day, if they haven't fled to Kona, I relent and take them to the beach. To Kamoamo, that is, a black sand beach where there was none four years ago, formed from the gritty debris of lava that flowed into the sea just to the east. At night, if the cockroaches haven't carried you off, you'll see the light dim along the wild, deserted, magnificent coast all the way to Ka Lae (South Point) and the sky to the north light up with the glow from the lava pond at Pu'u'O'o. The waves pound the coast hard enough to send a tremor through the cindery sand, and the wind carries a hint of sulfur mixed with the lonely, wild taste of thousands of miles of open sea. Every now and then, one of my visitors will happily abandon her dream of paradise and stand there transfixed by the power of the land. 

Raised in Hawai'i, Pamela has been a country school teacher in Montana, a homesteader in Idaho, and an apple grower in California. She wrote for the *Whole Earth Catalog* in the 1970s under the nom de plume Rosella Hips. She has written on environment and Native Hawaiian rights for *The Hawaii Observer*, and wrote *The Burning Island: A Journey Through Myth and History in Volcano Country, Hawai'i* (Sierra Club Books, 1991). —EP



Left:
Haley
(Filipino,
English,
Chinese,
Irish,
Spanish)

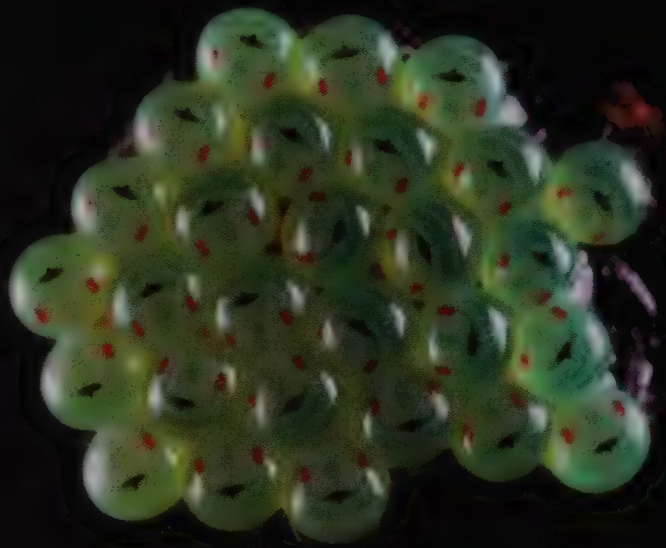
RAINBOW KIDS
Hawaii's Gift to America

C. Richard Fassler. 1998; 96 pp. \$24.95.
White Tiger Press.

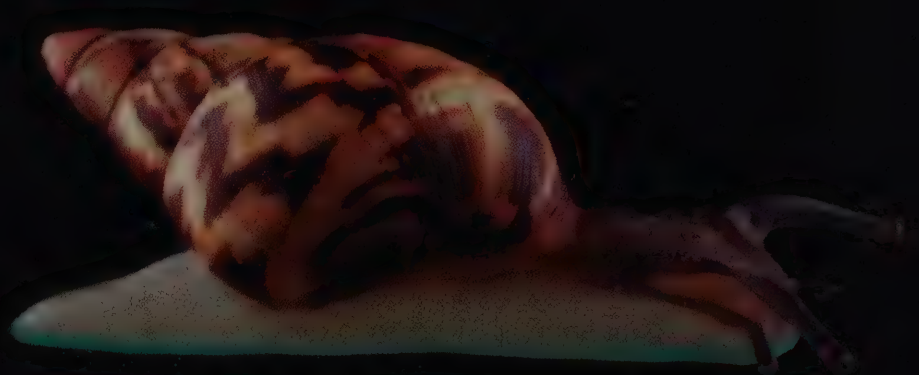
A look at more than 100 photos of Hawai'i's multiracial children of all different ages will leave you smiling. Informative and opens-up-your-heart accepting. —EP

FOR INFORMATION ON
COLOR PHOTOS
BY D. LIITTSCHWAGER AND
S. MIDDLETON see page 77











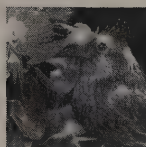






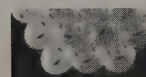
ENDANGERED HAWAIIAN NATIVES HOLDING ON

PHOTOGRAPHS BY DAVID LIITTSCHWAGER & SUSAN MIDDLETON
IN COLLABORATION WITH ENVIRONMENTAL DEFENSE



'Akohekohe Crested Honeycreeper;
Palmeria dolei.
(Size: 6-7") Keauhou Bird Conservation Center, Volcano, Hawai'i.

This captive 'Akohekohe lived up to its species' reputation as the most gregarious native Hawaiian forest bird. He comes from a wild collected egg from Maui and was one year and about four months old when he passed. The wild population has dwindled to about 300 individuals, mostly from the introduced avian pox and avian malaria. These diseases came with the arrival of many species of nonnative birds and are transmitted by mosquitoes, also alien to Hawai'i.



Koa Bug; eggs; fourth instar nymph; newly emerged adult; adult;
Coleotichus blackburniae.
(Adult size: 1.25") At temporary studios, Hawai'i and Maui.



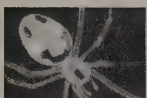
The Koa bug is the unintentional victim of a whole series of human-introduced invaders. Two well-intended biological control agents (a parasitic fly and a parasitic wasp) found the Koa bug to be good food. Ants, again and again (there were no social insects in Hawai'i before the arrival of man) found the Koa bugs essentially defenseless. The most immediate predator and threat is the accidentally introduced spider, *Cheiracanthium mordax*.



Molokai Tree Snail;
Partulinia mighelsiana.
O'ahu Tree Snail;
Achatinella livida.
Big Island Tree Snail;
Partulina physa.
(Size: 3/4") Conservation Lab, University of Hawai'i, O'ahu.



All species of Hawaiian Tree Snails have suffered greatly. First came the destruction of lowland forests, then the accidental introduction of rats. More recently, Hawai'i attempted to control an accidentally introduced agricultural pest species of snail by importing still another snail, the carnivorous *Euglandina rosea*. This misguided and mostly ineffective attempt has further contributed to the demise of native snails.



Happy Face Spider;
Theridion grallator.
(Size: Less than an inch)
Center for Conservation Research and Training

Lab, University of Hawai'i, O'ahu. Collected Waianae Mountains, Honouliuli Preserve, TNC, O'ahu.

The Happy Face spiders were found on the very same *Pisonia* tree as the *Drosophila ambochila*. The face-like abdominal markings may be an evolutionary adaptation to avoid being eaten by birds.



Kaua Pisonia picture wing pomace fly;
Drosophila ambochila. (Size: 4mm) The Nature Conservancy, Honouliuli Preserve, O'ahu. Photographed at Center for Conservation Research (as above).



The Kaua Pisonia picture wing pomace fly, one of more than 1,000 kinds of Hawaiian *Drosophila* (lovers of dew) has been found only in one small area within the wider occurrence of the *Pisonia* tree. The picture wing pomace fly feeds only on *Pisonia*. Because these flies face the destruction of their host plant by continental swine, pig fences are absolutely necessary for their survival. Note that both flies are the same species. The iridescence shines when on a black background; the "picturing" shows when light passes through the wings.



Nehe; *Wollastonia waimeaensis*. (Size: 1") National Tropical Botanical Garden, Kaua'i.

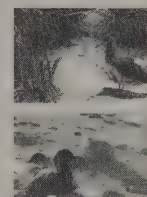
Only one wild population of *Wollastonia waimeaensis* (called "Nehe" in Hawaiian) is currently known. The US Fish and Wildlife Service lists this population as containing more than 100 individuals. Guided by Steve Perlman of the National Tropical Botanical Garden, we sought to portray a wild plant. Only two plants could be found, and, due to continuing drought, their flowers were in poor condition. The steep terrain would have made in situ photography very difficult and possibly dangerous for the plants, the surrounding area, and ourselves. For both aesthetic and safety reasons, we returned to the Botanical Garden to photograph a plant grown from previously collected wild seed.

The photographs shown here were made with the assistance of the following people and institutions: Steve Perlman and the National Tropical Botanical Garden; Cyndi Kuehler, Alan Lieberman, and the Keauhou Bird Conservation Center; Steve Montgomery; Tracy Johnson and the University of Hawaii at Manoa; Cindy Rehkemper and the US Fish and Wildlife Service, Pacific Remote Islands, National Wildlife Refuge Complex; The NOAA Ship *Townsend Cromwell*.



Kokia; *Kokia drynarioides*.
(Size: 6") National Tropical Botanical Garden, Kaua'i.

Kokia drynarioides, a species closely related to cotton, can grow up to 35 feet tall if not trampled by cattle or destroyed by wildfire. The entire known wild population of only five individuals lives in a severely degraded dryland forest on the Island of Hawai'i. When the trees were more plentiful, the Hawaiians made medicine and dye from their flowers and bark.



Laysan albatross;
Diomedes immutabilis.
(6.5' wing spread).
Laysan Island.

The tracks across the sand are from a juvenile albatross. The grass is native *Eragrostis*. Rabbits, introduced by a meat canning operation, denuded the island. Compounding the problem was the invading *Cenchrus* (sand burr), which prevented shade grass growth and stable sands. Without US Fish and Wildlife intervention, nesting would have been lost. This beach faces the current of the open ocean, hence a steady stream of trash. Plastic enters parental stomachs and covers the coral reefs.

David and Susan have collaborated on Here Today: Portraits of Our Vanishing Species (on California) and Witness: Endangered Species of North America. They are freelancers, specializing in endangered species for the last fourteen years. This work was done in collaboration with Environmental Defense (www.environmentaldefense.org), a heavy hitter in energy, water, and endangered species policy. Luckily, Environmental Defense balances its desire to protect with its eye for the planet's beauty. These photos and many more will be a National Geographic book, and mounted as a traveling exhibit by the Smithsonian Institution Traveling Exhibition Service (both in the fall of 2001). Most photographs were made with a Hasselblad 553ELX camera and a Zeiss 135mm Macro-Planar lens. The film is generally Kodak Ektachrome E100SW. Except for the landscapes, electronic flash is the principal light source. All photos Copyright 1998/99 David Liittschwager and Susan Middleton.

ISLAND SOVEREIGNTY



PHOTOGRAPH BY GREEVY, CULTURAL SURVIVAL QUARTERLY, SPRING 2000.

by Ian S. McIntosh

France, Spain, or England. Following the Spanish-American War, the US entered the colonial arena by strategically acquiring land for military and other purposes in the Philippines, Guam, Hawai'i and American Samoa. Following World War I, Japan and Australia took control of former German territories.

Between 1962 and 1980, most of the Pacific's colonial territories—Fiji, Tonga, Samoa, Vanuatu, Solomon Islands, Tuvalu, and Kiribati—achieved independence. For many other Pacific islands, however, the colonial era has not ended. Semi-colonial states in the Pacific include the Cook Islands and Niue, which are self-governing entities in free association with New Zealand. US-incorporated territories include American Samoa, Midway, Northern Marianas, Marshall Islands, and Federated States of Micronesia.

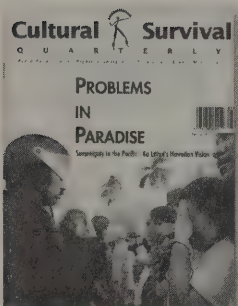
At the same time, the Indigenous Kanaka of Kanaky (New Caledonia), the Haohi of Tahiti, and Te Ao Maohi (French Polynesia) are under the direct control of France. The French view their colonies as part of the French Republic. Inhabitants are first and foremost French and indigeneity is construed by authorities as unconstitutional and a threat to the integrity of the French nation. Likewise, the Maori of Aotearoa, the Aborigines of Australia, and the Kanaka Maoli (Native Hawaiians) of Ka Pae'aina (Hawai'i), have been permanently incorporated into imperial cultures.

Listening to the voices of the Ka Lāhui movement, it is apparent that the colonial era is far from over in Hawai'i. As with so many other beleaguered indigenous societies, massive depopulation, landlessness, political marginalization, institutionalization, poor health and educational profiles, and an increasing diaspora, are key features of the indigenous condition of Kanaka Maoli.

One important way of supporting the indigenous struggle is the promotion of the pre-existing solidarity that once existed amongst indigenous peoples in the Pacific. In recent times, regional and international cooperation has been facilitated through the emergence of organizations such as the Pacific Island Association of NGOs (PIANGO), which was established in 1990. Its aim is to promote solidarity and provide a common voice of the Pacific's indigenous

So rarely are Polynesian, Micronesian, or Melanesian news items featured in the US media, that the image of dreamy tropic islands persists in the western imagination. A tacit conspiracy by the media's advertisers and proponents of the tourism industry? The dawning of the new millennium at Kiribati and Fiji received blanket television coverage, but the rise of the Guadalcanal Indigenous Revolutionary Party in the Solomon Islands, civil unrest in Samoa, the movements for independence from France in Kanaky (New Caledonia) and Tahiti, and continued battles for justice and reparations in the Marshall Islands, Bougainville, and elsewhere—received little or no press. Indigenous voices like those of the Chamorro of US-dominated Guam, or the Rapanui of Chilean-administered Easter Island, are seldom heard.

Since the days of J.R. Foster, naturalist aboard Captain Cook's *Resolution*, scholars have designated three broad and somewhat artificial geographical, cultural and linguistic zones—Micronesia, Melanesia, and Polynesia—a division that downplays important similarities and connections between the island nations. Largely a legacy of the colonial era, the political make-up and living conditions in Pacific nations are diverse. By the mid 1800s, most Pacific islands had been claimed by either Germany,



Excerpted with permission from *Cultural Survival Quarterly*, Spring 2000 (Sara Wilmot, Managing Editor. Included with membership (\$45/year) in Cultural Survival, Inc., 215 Prospect Street, Cambridge, MA 02139. 617/441-5400, csinc@cs.org, www.cs.org).

communities. PIANGO has allowed for the vital exchange of information on the methods of transcending the juridical frameworks of introduced colonial laws and the promotion of new ways to model systems of government to reflect island custom.

The Internet, also, has played a significant part in reducing island isolation. SIDSnet, for example, has become a major forum for the sharing of ideas on biodiversity, sustainable development, and climate change.

Another significant success story in the advancement of island solidarity is the Polynesian Voyaging Society, which, since 1975, has been sponsoring voyages retracing the epic sea travels of early Polynesians. The society's aim has been to show that a voyaging canoe of Polynesian design could be navigated (non-instrumentally) from island to island up to distances of thousands of miles following traditional routes, proving that Polynesian sea-

farers settled the many islands of the South Pacific through maritime skill and not by accident as some scholars argue. Since 1992 the organization's goals have changed; the society now emphasizes education and is seeking new and innovative ways to preserve 'the land, sea and people of Hawai'i.'

According to Native Hawaiian elder Leialoha Perkins, the Polynesian voyaging canoe venture has generated tremendous excitement in the Native Hawaiian community. There is a real sense of connection to all the isolated peoples of the Pacific and of re-establishing the Native Hawaiian sense of their Pacific connections. The voyages have provided an opportunity for native peoples to set aside their differences and consider the possibility of reuniting with their relatives across the seas. **WE**

Ian McIntosh is the coordinator of special projects for Cultural Survival, Inc.

HAWAII

THE BIOREGION

HAWAII SOVEREIGNTY, or How Some Kanaka Maoli (Native Hawaiians) Want Ka Pae'aina (Hawai'i) Back

In 1893, the US military invaded Hawai'i. In 1896, the US banned the Hawaiian language. By 1900, Hawai'i became a territory. In 1959, voters chose between remaining a territory and becoming a state (no independence or commonwealth options were offered). They opted for statehood. In 1994, Ka Lāhui wrote the most comprehensive plan for the attainment of Hawaiian sovereignty.

Should Hawai'i be a nation within the US (the Native American model)? Be divided into two states, one for the Kanaka Maoli? Be independent (a small minority wants independence plus restoration of the monarchy)? —PW

Organizations

INDEPENDENT AND SOVEREIGN HAWAII

<http://hawaii-nation.org/nation/>
41-1300 Waikupanaha Street, Waimanalo, Oahu, HI, 96795. 808/259-9018.

Hawai'i's premier sovereignty Web site. News articles, photos, background

info, history, and all the reasons why Hawai'i should be independent from the US.

KA LĀHUI HAWAII
www.unpo.org/member/hawaii/hawaii.html

A kind of "government in exile," representing the Kanaka Maoli in the Underrepresented Nations and Peoples Organisation (UNPO).

OFFICE OF HAWAIIAN AFFAIRS (OHA)

711 Kapi'olani Boulevard, Ste. 500, Honolulu, HI 96813. 808/594-1888, oha@aloha.net, www.oha.org.

Disperses funds received from lands held in trust by the state for Native Hawaiians. Part-Hawaiians (less than 50 percent ancestry) make up 70 percent of the 200,000 Hawaiians in Hawai'i. Huge inequities on who should receive and how much should be dispersed have helped spur the sovereignty movement.

CALL FOR HAWAIIAN SOVEREIGNTY

Michael K. Dudley. 1993; 177 pp. \$12.95. *Na Kane O Ka Malo Press*. Available from www.hawaiibooks.com.

Half history and half discussion of the plight of Hawaiians. Explains what happened, gives text of

President Cleveland's message to Congress recommending the restoration of the Kingdom, discusses fate of Hawai'i under non-Hawaiian rule and current movement. A fast read and good overview. —Bill Taylor

NATION WITHIN The Story of America's Annexation of the Nation of Hawaii

Tom Coffman. 1998; 345 pp. \$20. Epicenter. www.hawaiibooks.com.

A readable book about a difficult and emotional subject—the theft of Hawai'i. If you want to understand what really happened, and why indigenous people are still so angry about it, read this book. —Bill Taylor

THE ACT OF WAR The Overthrow of the Hawaiian Nation (video)

Na Maka o Ka 'Aina in association with the Center for Hawaiian Studies. 57 mins. \$40 postpaid for home video use. *Na Maka o Ka 'Aina*. PO Box 29, Na'alehu, HI 96772. 808/929-9659, video@amaka.com, www.namaka.com.

President Cleveland described the landing of US troops at Honolulu 1893 as "an act of war." In this video, scholars tell Hawaiian history through Hawaiian eyes.

Other Island Resources

SOUTH PACIFIC REGIONAL ENVIRONMENT PROGRAMME (SPREP)
PO Box 240, Vaitele, Apia, Samoa. (685) 21929, sprep@sprep.org.ws, www.sprep.org.ws.

Regional organization established by governments of twenty-two Pacific island countries and territories, along with Australia, France, New Zealand, and US. Strategies include biodiversity and climate change.

SMALL ISLAND DEVELOPING STATES NETWORK (SIDSNET)
Sustainable Development

Networking Programme (SDNP), United Nations Development Programme (UNDP), 304 East 45th Street, Room FF-634, New York, NY 10017. 212/906-5511, sidsnetmaster@sdnhq.undp.org, www.sidsnet.org.

A way to make a web faster than boat voyages and telephones. Sponsored by the UNDP and the Alliance of Small Island States. Covers forty-two island nations, empowering stakeholders in UN-ease.

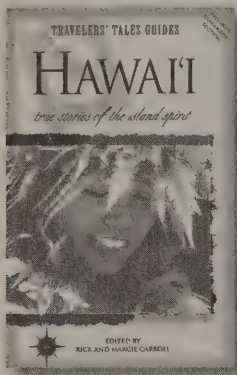
RMI ONLINE

www.rmiembassyus.org, hbarker@rmiembassyus.org.

See for consequences of nuclear weapons programs on the peoples of the Marshall Islands.



BIOREGIONAL PILIKIA ("TROUBLE")



HAWAII
True Stories of the Island Spirit
 Rick and Marcie Carroll, eds. 1999; 394 pp.
 \$17.95. Travelers' Tales.

Travel with it. Another winner from the estimable Travelers' Tales series of first-person "This happened to me!" narratives. Better than guidebooks for conveying the venturing experience, or if you're too poor to pay for a trip but want to take the island journey through others' eyes. *Hawaii* features memories, insights, and wisdom from a few well-known writers—Barbara Kingsolver, Paul Theroux, Maxine Hong Kingston, Rick Bass, Jan Morris—and forty more whom you'll want to meet over piña colodas. —Whole Earth staff

“ These Islands, when they first lifted their heads out of the waves a million years ago, were naked, defiant rock—the most isolated archipelago in the world. Life, when it landed here, arrived only through powerful stamina or spectacular accident: a fern's spore drifting on the trade wind, a seed in the craw of a bird, the bird itself. If it survived that was an accident all the more

spectacular. Natural selection led these survivors to become new species unique in the world: the silver-sword, for example, a plant that lives in lava beds and dies in a giant flowery star burst; or the nēnē, a crater-dwelling goose that has lost the need for webbed feet because it shuns the sea....Over the course of a million years, hundreds of creatures like these evolved from the few stray immigrants....

...The Polynesians came first, bringing along some thirty plants and animals they considered indispensable, including bananas, taro, sugarcane, pigs, dogs, chickens. And also a few stowaways: rats, snails, and lizards. All of these went forth and multiplied...Each subsequent wave of human immigration brought fresh invasions. Sugarcane and pineapples filled the valleys, crowding out native herbs....Pigs, goats, and cattle uprooted and ate whatever was left. Without a native carnivore to stop them, rats flourished like the Pied Piper's dream. Mongooses were imported in a hare-brained plan to control them but the mongoose forages by day and the rat by night, so these creatures rarely encounter one another. Both, though, are happy to feast on the eggs of native birds.

Ho'oponopono ("Making Things Right") COMPILED BY EMILY POLK

HAWAIIAN ECOSYSTEMS AT RISK PROJECT (HEAR)

c/o Research, P.O. Box 369, Makawao, HI 96768.
 808/572-4418, pt@hear.org, www.hear.org.

HEAR provides information to land managers, decision makers, and the public about nonnative species and other threats to the economy and ecology.

ENVIRONMENT HAWAII

Patricia Tummons, ed. \$35/year (12 issues). 282 Ululani Street, 1st Floor, Hilo, HI 96720. 808/934-0115, environment-hawaii.org.

Extensive and timely coverage of environmental issues impacting Hawaii's land, people, and ocean resources.

ECOTOURISM AND ECO-ACTIVISM

Midway Atoll National Wildlife Refuge in the remote Northwestern Hawaiian Islands is now open for limited ecotourism (www.r1.fws.gov/midway).

Midway and French Frigate Shoals maintain volunteer wildlife service programs. —Pamela Frierson

For info on protection of Hawaii's Pacific leatherback turtles, threatened by longline fishing, see www.seaturtles.org.

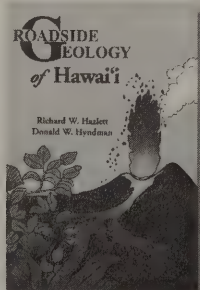
21ST CENTURY HAWAII

www.21stcenturyhawaii.com.

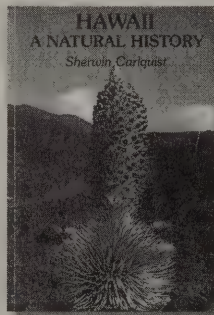
An online guide to experiencing the Big Island environment, endangered species, and eco/nature travel.

ROADSIDE GEOLOGY OF HAWAII

Richard W. Hazlett and Donald W. Hyndman. 1996; 307 pp. \$20. Mountain Press Publishing Company.



Geo-tourism at its best. Know the ground you stand on. On the Islands, it moves, mists over, or is eaten by the sea.



HAWAII
A Natural History
 Sherwin Carlquist. 1992; 468 pp. \$34.95. Available from National Tropical Botanical Garden gift shop, 808/742-2433.

Single-stop shop for everything native. Lusciously illustrated.

ENJOYING BIRDS IN HAWAII

A Birdfinding Guide to the Fiftieth State
 H. Douglas Pratt. 1993; 195 pp. \$18.95. Mutual Publishing.

Where's the best birding? Historical and ecological info.

THE BIRDS OF HAWAII AND THE TROPICAL PACIFIC

H. Douglas Pratt, Phillip L. Bruner, and Delwyn G. Berrett. 1987; 409 pp. \$35. Princeton University Press. Available from Los Angeles Audubon Society, (323) 876-0202.

A birdwatcher going to Hawaii without this book would be like the Pope going to mass naked. It's the best.

THE LIVING TREASURES OF THE HAWAIIAN ISLANDS

The Story of Hawaii's Native Plants and Animals
 Stacey Kaopuiki and Bob Wagstaff. 1994; 44 pp. \$14.95. Hawaiian Island Concepts.



Best children's guide. Big, colorful illustrations.

KALAKAUA MARINE EDUCATION CENTER
 University of Hawaii at Hilo, 200 West Kawili Street, Hilo, HI 96720. 808-974-7544, kmec@hawaii.edu, www.kmec.uhh.hawaii.edu.

The center's offerings include a marine sciences major and summer programs on the Big Island and at Midway Atoll.

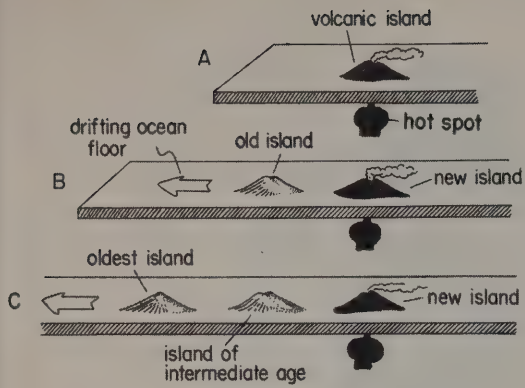
HAWAII

THE BIOREGION



More species have now become extinct in Hawai'i than in all of North America....Of the original cornucopia of native birds....including fifty species that were all flightless, like the dodo...[are] now, like the dodo, all gone. A total of only thirty endemic bird species still survives.

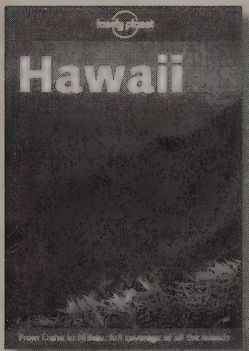
It's quite possible now to visit the Hawaiian Islands without ever laying eyes on a single animal or plant that is actually Hawaiian—from the plumeria lei at the airport (this beloved flower is a Southeast Asian import) to the farewell bouquet of ginger (also Asian). African flame trees, Brazilian jacarandas, mangoes and banyans from India, coffee from Africa, macadamia nuts from Australia—these are beautiful imposters all, but to enjoy them is to dance on a graveyard. Exotics are costing native Hawai'i its life. —BARBARA KINGSOLVER



The Hawaiian Islands sit on top of "hot spots," abnormally hot rocks firmly rooted in the earth's interior. The islands form as they pass over the hot spot and then move off it with the drifting ocean floor.

FROM *ROADSIDE GEOLOGY OF HAWAII*.

Kukulu Kumuhana ("Pooling of Strengths for a Shared Purpose")



ATLAS OF HAWAII
Sonia P. Juvik and James O. Juvik, eds. 1999 (3rd ed.); 352 pp. \$49.95. University of Hawai'i Press. 2840 Kolowalu Street, Honolulu, HI 96822. 808/956-8255, uhpbooks@hawaii.edu, www.uhpress.hawaii.edu.

MAPS OF HAWAII'S ISLANDS
\$3.95-\$7.95 (\$1.50 shipping for first map; 50 cents for each additional). University of Hawai'i Press.

Along with the exquisite *Atlas*, updated in a new edition, the University of Hawai'i Press publishes maps of Hawai'i, Maui, Kaua'i, Moloka'i and Lana'i, O'ahu, and Oceania.

HAWAII
Glenda Bendure and Ned Friary. 2000 (5th ed.); 623 pp. \$19.95. Lonely Planet.

Even a native hula master can find something useful in this comprehensive guide to all the islands. Lonely Planet also publishes a guide to diving and snorkeling, and individual guides to the major islands.

HAWAII PONO ("HAWAII THE EXCELLENT")
An Ethnic and Political History
Lawrence H. Fuchs. 1961; 501 pp. \$14.95 (\$15.85 postpaid). Bess Press, 3565 Harding Avenue, Honolulu, HI 96816. 800/910-BESS, 808/734-7159, email@besspress.com, www.besspress.com

The best political history: racism, paternalism, charity. Hawaiians, Americans, Japanese, Filipinos, Chinese. Before Mexican Kona coffee pickers. Great biblio.

VIDEOS FROM NA MAKA O KA 'AINA
PO Box 29, Na'alehu, HI 96772-0029. 808/929-9659, www.namaka.com.

Na Maka o ka 'Aina offers more than forty videos on Hawaiian culture, history, and environment. If you're from Hawai'i or have a strong interest, see especially *Aloha Quest* (Parts I and II, 60 mins., \$35 each, postpaid \$40), a detailed, up-to-date history, and *An Act of War* (see page 79).

HAWAII'S SPAM® COOKBOOK

including recipes for

- ✦ sardines
- ✦ corned beef &
- ✦ vienna sausage

Ann Kondo Corum

PANILOLO O HAWAII
Cowboys of the Far West (video)
80 mins. \$19.95. Filmworks Ltd. PO Box 61281, Honolulu, HI 96839-1281. 808/537-6813.

Edgy Lee's inspiring, romantic epic. Old and new footage, interviews, music, and reenactments give voice to a dying breed of island cowboys who were once the heart of Hawai'i.

HAWAII'S SPAM® COOKBOOK
Ann Kondo Corum. 1987; 136 pp. \$8.95. Bess Press (see above).

America's favorite love-to-hate food has found a home in creative Hawaiian cuisine. Easy-to-cook recipes include Spam musubi, won ton, fishcake pupu mix, Spam chowder. Great illustrations.

SPAM: A BIOGRAPHY
Carolyn Wyman. 1999; 134 pp. \$15. Harcourt Brace and Company.

The entire history, from Jay C. Hormel to *Monty Python* and the Internet, spiced tongue in gelatinous cheek, with scrumptious illustrations and recipes. (Ready for Pig Newtons?)

THE FOLDING CLIFFS
A Narrative of 19th century Hawaii
W.S. Merwin. 1998; 331 pp. \$16.95. Knopf.

The most moving poetic narrative of Hawai'i, it follows one native family's attempt to flee when the American government decides to seize possible victims of leprosy.

STORIES OF HAWAII
Jack London. 1994; 282 pp. \$6.95. Mutual Publishing.

Some of London's best (and least known) writing is in this collection of stories.

LETTERS FROM HAWAII
Mark Twain. 1975. 298 pp. \$11.95. University of Hawai'i Press.

Before he was famous and before Hawai'i was part of the US, Twain went over as a newspaper correspondent. Here are twenty-five letters of vintage Twain.

HAWAII
James A. Michener. 1959; 1036 pp. \$7.99. Ballantine Publishing Group.

Farmers, missionaries, kings, queens, sailors, you've got it all in this sweeping island tale.

HAWAII UNDERGROUND
www.hawaii-underground.com

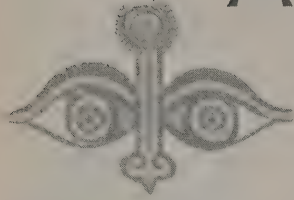
Hawai'i's off-the-beaten-track e-zine. The best hangouts, entertainment, local stories. The lived-in flavor of Hawai'i.

HAWAII ISLAND JOURNAL
Free. P.O. Box 2118, Kealahou, HI 96750. 808/929-8612. editor@hawaiijournal.com.

The voice of bioregional politics, culture, and music on the Big Island.

STARBULLETIN.COM
For the latest online news check out the *Honolulu Star Bulletin's* Web page. Covers news, business, features.

A GODDESS IN THE MAKING



Words and Photographs by Anna Portnoy

"Did you see it?"

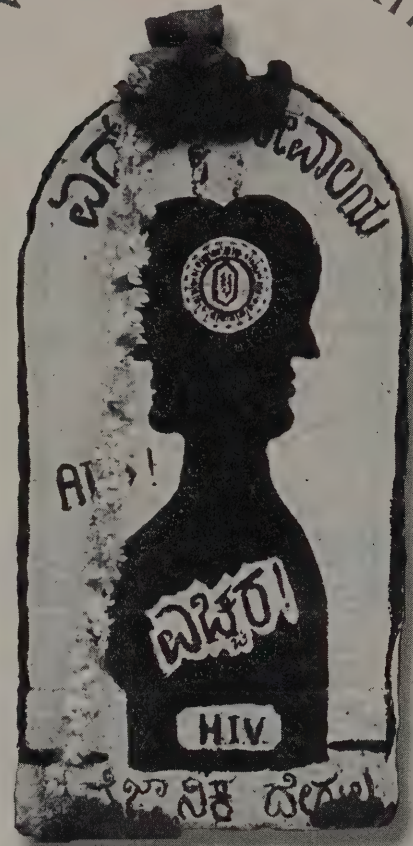
"See what?"

"AIDS-amma temple," said Girish, pointing to a white stone about ten meters to my left. I saw what looked like a gravestone, only it was painted white and set in a square of cemented ground. At the edge of the road in front of the high school, the only shelter this "temple" had was a canopy of sun-dried sugarcane branches.

"Wow," I said solemnly, masking my shock at its paltry stature. "This is it, the famous AIDS-amma temple." I had come halfway around the world for this. I had read about the temple in *India Today* magazine and written up a research proposal. I read books and took notes and asked advice. I pored over maps in a Bangalore bookshop trying to find this village of Menasikyathana Halli on a map, any map, only to discover that it was a village too small even to warrant a dot on a map. I rode the crowded bus amongst the gawks and gossip reserved for the once-in-a-lifetime sighting of a white woman on a local bus.

I guess I expected the temple to have walls. I knew that in India, everything from small stones to tree bark to jugs of water could be invested with sacred qualities, but the word "temple" suggested architectural fortitude. I imagined a building. Perhaps if there had been people chanting or on their knees praying, I would not have been so disappointed, but I could not even call the "temple" empty, for there was nothing to enclose it.

The whitewashed stone featured solid black silhouettes of a man's and a woman's torso. The figures were standing back-to-back. In the middle of their merging heads was a large red circle. Near the chest, Roman letters exclaimed "HIV!" Girish, the schoolteacher whose idea it was to create a new goddess of AIDS, told me that the Kannada letters said "AIDS-amma Temple" at the top and "Scientific Temple" at the bottom. Across the cemented floor, which covered an area of about sixteen square feet, purple chalk letters spelled the English word "Welcome," and a fresh garland of white and yellow flowers draped the stone.



THE AIDS-AMMA SHRINE.

A troop of barefooted children came running over, one after the other, and stopped haltingly before me. "They are so curious to see you," said Girish.

The schoolboys fought over who would carry my water bottle, the girls over who would take me to the bathroom or the field, as it were. The men climbed coconut trees to get me a mid-morning treat. The women brewed me tea.

As I hung out by the AIDS-amma temple, I got the sense that the villagers came less to see the temple than to see me at the temple.



People in Menasikyathana Halli, a village of 2,000, first heard the word "AIDS" in 1995 when a man from a neighboring village fell ill and went to the hospital. The man had AIDS; his wife did too.

"We would eat at the restaurant but we didn't know that they had AIDS," one local fieldworker told me, referring to the roadside food stall operated by the couple. "When the doctors told us they had AIDS, we stopped going there. Only then did we hear the word AIDS. We isolated them. Nobody touched them, because we thought that if we touched the person, we would die." Julappa, a village elder, said, "AIDS is a very cruel disease. It is bad for our country and society."

Girish told me that the couple died of starvation. "When there are no customers," he said, "there is no business, and when there is no business, there is no food." Others claimed that the husband died in the hospital and still others said that the man died when "doctors gave him an injection." According to a village leader, the wife was kept in a shed for the remaining days of her life. She had to cook her own food and eat in solitude.

Even when she died, they refused to touch her. "They lifted her corpse with sticks," one young man told me, "and burned her." Girish, though, said that the villagers would not grant her the typical cremation rite, but "with the help of sticks, dug a place for the body and buried it with sand and mud." Other villagers denied this, but couldn't offer alternative accounts. The hotly contested question about cremation rites is not surprising, given their crucial status in the local religion. These rites control the pollution occasioned by death, and also usher the soul from one life to another. For the villagers, failing to offer the deceased an honorable burial represents a drastic means of demonstrating moral disapproval.



"So my students told me about the couple's deaths and I took interest," Girish said. By the time Girish arrived in Menasikyathana Halli to serve as the science teacher at the newly erected high school in 1996, the couple with AIDS had died. What was left was their story, told by Girish to his students and by others, and then transformed into an impetus for action.

Girish's idea was to create a goddess (or "amma") of AIDS and to build a shrine for her. "Just to create phobia, I started AIDS-amma," Girish said, "but the people don't know that." He explained that this "phobia" (or "dread") of god has always served practical ends. For example, when one goes to the temple of Mari-amma, the goddess of chickenpox, one must keep one's skin dry and rub it with neem leaves. Neem works medicinally on the body, Girish

explained, but devotees think that the goddess cures them.

On AIDS Day, December 1, 1997, Girish planted the AIDS-amma stone under a tree outside the school. He paid for the stone and the paint out of his own pocket, which, with his modest teacher's salary, did not reach so deep. He told me this with the defiant dignity of a first-time owner, looking over at his goddess-in-the-making. Girish intended the figures of the man and woman to represent religion, and the red circle to represent the HIV virus, or, more

Girish's idea was to
create a goddess (or amma)
of AIDS and to build a
shrine for her.

generally, science. On the stone pillars to the right of the shrine, he painted "slogans," kernels of information he got from the World Health Organization. For several months, Girish gave weekly lectures at the shrine about AIDS, speaking first about more familiar diseases like malaria and chickenpox.

"Actually, they don't have information about anything," Girish said. "They are very innocent. How to teach them about such a modern disease? How to reach the village people? NGOs do publishing, but the village people don't know how to read, so how can the publications teach them? It is impossible, impossible! So, to reach them by means of phobia, I created a shrine."

Girish was careful to point out that he does not tell people that AIDS-amma will cure the disease. Other disease goddesses like Mari-amma are thought to cause as well as cure the disease for which they are named. The critics of AIDS-amma believe that by creating another disease goddess, Girish is only adding to the superstition that pervades the rural areas. Swami Agnivesh, the head of a Hindu reform movement called the Arya Samaj, and critic of the AIDS-amma temple, said in an interview that this new goddess would lead people to believe the deity's power was all they needed to protect themselves against the disease. But Girish says he entreats them to ask the goddess only for knowledge, not to be cured. "Please AIDS-amma, bless me with information."



"You want to see *puja*. I will arrange for it," Girish said. This is not exactly what I had in mind—staged worship—and I explained that it was important to my research to see *puja* under "natural conditions." *Puja* typically involves some kind of priestly incantation, the offering of fruits, flowers, and other gifts, and either ecstatic song or solemn prayer. In the case of the village mother-goddesses, it may also involve the sacrifice of live animals.

Girish insisted that the villagers did *puja* daily at the AIDS-amma temple, but too early in the morning for me to reach the village in time. A few days later, my translator and I left Mysore before dawn and arrived in the village while it was still asleep. We watched from a window in an open schoolroom and waited for the worshippers to arrive. They never did.

On Friday, three or four women did straggle over from the larger Pataladamma temple, which was set back another twenty meters from the AIDS-amma shrine. With the sound of Pataladamma's priest chanting in the distance, one of the women, a young mother, lit a stick of incense for AIDS-amma, while the others pressed their folded hands to their chests. The women were reluctant to discuss the temple or its subject. "We don't know anything about AIDS-amma," one said. "We don't know anything except that there is a disease called AIDS." I asked if there were a connection between the disease and the goddess and she told me that that is what educated people had told her.

The men in the village were more forthcoming about their knowledge of AIDS-amma. Most claimed to go to the temple every day and to pray for a "clean" or "clear" mind. They perceived the man and woman painted on the "idol" to be having sexual intercourse—a pictorial lesson in how the disease is transmitted. One man said, "The idol is quite fearsome. It's a woman and man because [AIDS] travels from woman to man."

AIDS in India is typically transmitted through heterosexual sex. Perhaps because a high percentage of prostitutes are carriers of the disease, it is a common misconception that women are the source of AIDS. Villagers also cited skin, lice, and saliva as carriers of the disease. An adolescent girl told me that one can contract the disease just by sitting next to an infected person.

And what were the powers of this new goddess to act on this disease? One man said that AIDS-amma was not going to cure the disease, because

there is no cure. Another said that AIDS-amma causes as well as cures the disease. And one middle-aged woman, with whom I managed to speak privately, railed against the temple and said that some people stay away from it because they think that they will get AIDS if they go.



One night in April 1999, about three months before my visit, someone—allegedly people from the neighboring village—slashed the temple stone in two pieces and painted over the slogans in a wash of red. The new AIDS-amma temple, which stood close to the border between the two villages, refueled a longstanding rivalry between them.

When I went to the neighboring village to learn something from AIDS-amma's detractors, most people looked the other way. Under the pretext of wanting to learn how jaggery (a solid cooking sugar) was made, my translator and I managed to get one man talking. He said that they did not object to forming a new temple, and cited a new temple in his village that is said to cure boils. Their concern had to do with the way in which Girish had gone about it. It was their understanding that AIDS came from sex, so they said it was morally wrong for Girish to build a temple for AIDS, because it associated sex with religion.



A student prostrates himself in front of the temple, for the benefit of the author and the amusement of his peers.

Some of the newspaper articles Girish carried in his binder claimed that he had even considered placing a box of condoms at the temple as *prashad* (offering). But such an open display of contraception would incite too much religious opposition, Girish told me.

"Nobody will go to the temple, that's for sure," said the man in the jaggery factory. "You've been

staying in the village since early morning. Have you seen anyone?" I hadn't.

If the vandalism accomplished anything, it was to rally the villagers of Menasikyathana Halli together in support of the shrine. The morning after the temple had been demolished, people from Menasikyathana Halli assembled themselves, passed around a collection, from which they got about 1,500 rupees, and got to work on rebuilding the shrine.

Immediately after the shrine was rebuilt, a union was formed to protect and develop it. The union treasurer, Chandrashkar, a man in his late twenties, spoke some English, and wore trousers, an urban distinction. "I don't ask anything of AIDS-amma," he said. "I don't want anything. I just want to advertise it and make people know there is a temple of AIDS-amma. I want people to be aware. Instead of thinking it is a deity, our union thinks it is a way of advertising the union's name."

People in the other village shunned publicity. They didn't want to be saddled with the reputation for having AIDS. (It was in their village that the couple had died of AIDS five years ago.) If ever the people of Menasikyathana Halli shared the same fear, they all but eradicated it. They seemed to have faith that the publicity would bring them good fortune.

"We will collect funds from the people," Chandrashkar said. "Our union has spent a thousand rupees already. I feel that AIDS-amma is not as popular as Basava (the popular South Indian deity for whom a shrine is built in the village center), but once people believe that it is important, they will be ready to help to any extent."



On my last day in the village, I asked Girish if there was anything further that he wanted to be sure I included in the story of AIDS-amma. "You should tell them this is a unique temple on Earth, not only for Mandya [district], India. It is a unique temple on Earth. Solely [for that reason], it is attracting media."

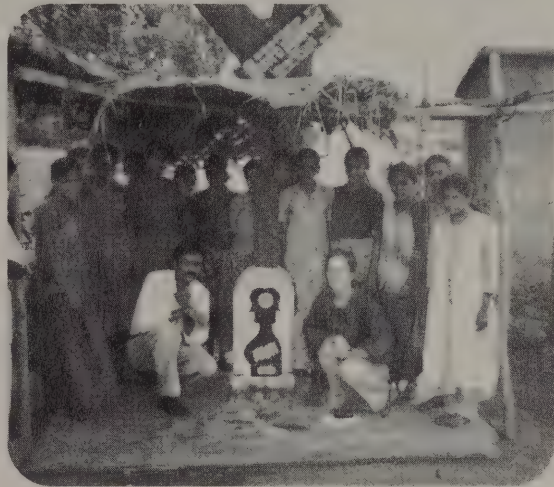
From the time of the temple's original inception, dozens of publications from Bombay to Chennai had picked up the story. Wherever he went, Girish carried a red-spined portfolio with clear plastic sheets protecting hand-dated newspaper clippings about the AIDS-amma temple.

The articles were about the ostracized couple, the "innovative" temple, and AIDS-amma's resemblance to other disease goddesses. They also told about "devotees thronging the new temple" and

buses stopping at the temple "to allow passengers to have a quick *darshan* [viewing] of AIDS-amma."

I had come in the trail of journalists, the temple's secularly minded pilgrims. "If you came from such a developed country to study my work," Girish said, "I will do a little more."

Yet Girish could not be sure what would come next. The typical evolution of a temple would lead to the presence of a priest and sacrifices. These measures might increase the religious clout of the temple among villagers, but they might also dim the educational components of the "scientific temple." The secularly minded writers and readers of newspapers, many of them suspicious of religious trap-



Girish and the author (kneeling), students, and onlooking villagers in the AIDS-amma temple.

pings, might call it a sham. And as one insightful villager put it to me, "We can't name a priest for this goddess, because others will think that it has been created to earn money."

For the most part, the villagers seemed to want to defer to Girish for making decisions about the development of the temple. One villager said, "If they tell us to give sacrifices, we will." When I asked who "they" are, he replied, "Girish master. He created it, so he should say. He is the man behind this."

Girish may be the man behind the goddess. He seemed much like the proud and protective parent of an infant child as he anticipated her growth and, indeed, walls on her shrine. I kept on wanting to separate man from goddess. I wanted to distill in

AIDS in India Information

from National AIDS Control Organization (www.naco.nic.in)

- The first case of AIDS was reported in India in 1986. Since then, the number of HIV infections has risen every year.
- An estimated 2.3 to 3.5 million people are infected with HIV in India today, with the highest concentration in the southern, urban areas.
- More than half of those polled contracted AIDS through heterosexual sex.

I became fixated on
 the question of whether
 AIDS-amma was a “real”
 goddess in the minds of
 the villagers, but they
 would not grant me
 the clear-cut answer
 I hoped for.

some pure way the “truth” about the goddess from Girish's claims. I became fixated on the question of whether AIDS-amma was a “real” goddess in the minds of the villagers, but they would not grant me the clear-cut answer I hoped for. They told me simply to “wait and see.” I had a flight back to Boston in two weeks and little patience for this “trial and error” method of sorting out the divinities from the quacks.

Yet if AIDS-amma turned out not to be “real,” her shrine might still be important as a vehicle for AIDS education. Clearly, misconceptions still circulated about how the disease spreads, but I wondered if a greater number of people had become educated



Girish in
 his home
 in Mysore.

about the disease because of the AIDS-amma. This proved equally difficult to determine. Estimates by villagers of the percentage of villagers aware of the disease and how it spread ranged from 20 to 90

percent. Outside the village, people were similarly in disagreement about whether this shrine had raised awareness. I once found myself in the middle of a friendly argument between an area doctor, who thought that the shrine had made people more aware, and a representative from the health department, who said that it had made no impact whatsoever.

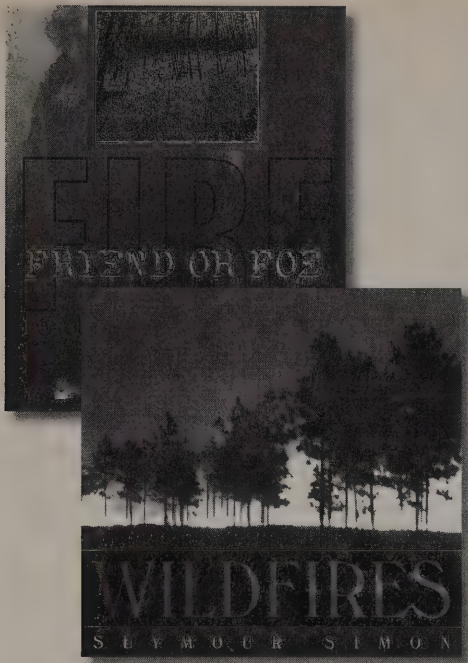
And while people from the health department and from the newspapers and TV stations, and one from an American university, tried to figure out what kind of significance this new deity had for AIDS education, health, and religion, the villagers themselves went on with their daily lives. They irrigated the fields, carted crops to the city in ox-pulled wagons, filled jugs of water at the well, rinsed clothes in the stream.

They just come and go, a village elder told me when asked about the effect of the media. And that is what I did. I may have left a trail of gossip in my wake, and unwittingly drawn exaggerated attention to the new goddess, but I came and went and didn't stay long enough to know what they know.

I very much feel that I contributed to the shrine's significance. I often say that as the first white person most of these people had ever seen, I felt that I was a walking billboard for the shrine. A TV show filmed a segment about AIDS-amma on my last day there—they didn't want to miss me, they said, for my picture really made the story for them.

My feelings about the sacred did change with all the reflection I did upon returning and preparing for my thesis. What strikes me about this situation is that a divinity is emerging (or not) in the midst of all this human contestation. As a student of religion, I kept looking for signs of the sacred (i.e., ritual, myth) when it was staring me in the face. Here are people who have been in this village for generations without the outside world paying any attention, and all of a sudden, people are interested in them and their village. I guess what I'm trying to say is that I saw nothing *inherently* sacred, and more or less gave up the idea that there is *anything* inherently sacred. I feel instead that the village contestation over local identity, the human longing to be known, the fear inspired by AIDS—these are the dynamic sources that may ultimately anchor the shrine as sacred. ☪

While a Harvard junior, Anna caught wind of the new goddess. The Harvard College Research Program and Asia Center funded her trip to the state of Karnataka in South India where she visited the village on and off for three weeks in July–August 1999. Villagers spoke Kannada. They were Lingayat and Gowda peoples; all Hindu. She was associate editor of *Let's Go: India and Nepal* (1997), a budget travel guide. She's looking for a job as a journalist and, given her clarity and smarts and fun cooperation, we'd like to put in (out) good words, praise, and help (anna_portnoy@yahoo.com). She recommends *Darsan* by Diana Eck for popular living religion in India, and Robert Cole's *Doing Documentary Work* for how to tell ethno-stories. —PW



FIRE
Friend or Foe

Dorothy Hinshaw Patent; photographs by William Muñoz. 1998; 80 pp. \$16. Clarion Books.

WILDFIRES

Seymour Simon. 2000 (reissue ed.); 29 pp. \$8.95. Harper Collins Juvenile Books.

The great Yellowstone fires of 1988 inspired a whole slew of books for children. These two are particularly good, written by a couple of the best children's science writers and illustrated with dramatic and beautiful pictures. Each juxtaposes the present attitude of encouraging periodic fires—as a way to recycle nutrients and open forests to sunlight and new growth—with the terror of fire so graphically portrayed in the movie *Bambi*. Good as these books are, children will most likely read them only if they are doing a class report on fire, or if they are about to visit Yellowstone.

Fire: Friend or Foe is longer and more extensive, with really good descriptions of just what fire is; of how humans use it to shape our prairies, wetlands, and forests; of smokejumpers and fire-fighting equipment; and of the ecology of fire. Each topic is illustrated with superb photographs.

Wildfires is the one I'd sit down and read to a child (about four to eight years) purely for pleasure. Simon just knows how to write in an engaging, absorbing way that never feels "lecturey." As always, his photographs are spectacular. —Molly Bang

Oddly, neither depicts children standing around and looking at fire. One photo to ease culturally instilled fear would make these fine books finer. —PW



FROM FIRE: FRIEND OR FOE

“When human populations were small and the wild world was large, slash and burn agriculture wasn't too destructive. Eventually, forests bordering the treeless areas took over again. But as the human population grew, it overwhelmed the forests. Today, this ancient technique, along with clear-cut logging, is rapidly depleting the great rain forests that span the equator and help regulate the world's weather. —FIRE: FRIEND OR FOE

“For many years, Smokey the Bear warned that “only you” could prevent forest fires, making people think that all fires were enemies. But wildfires are a fact of life in the wilderness, and plants and animals have adjusted to them. Many trees are so dependent on fires that they need cycles of fire in

order to grow...

In fact, aggressively fighting fires has probably decreased the number of wildfires that help a forest renew itself while increasing the number of more dangerous fires. —WILDFIRES

“After a fire, burned areas quickly burst into life. In fact, when the ground is still warm from the fires, ants, wood beetles, millipedes, and centipedes are busy. Fire beetles actually seek out fire to breed and lay their eggs in charred logs. The first plants that appear are those whose roots and seeds were there before the fire. But soon new seeds are carried in by the wind and on the fur of animals or in their droppings.

—WILDFIRES

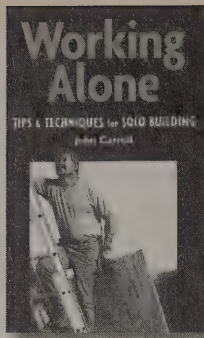
FIRE SAFETY HOUSE

Average price “about \$30,000.” Scotty/Mobile Concepts, Amcel Center—Box 1007, Mt. Pleasant, PA 15666. 800/783-0213, www.scottyrv.com.

Scotty has sold more than 500 of these mobile hands-on “classrooms” to communities and fire departments around the country. The kitchen, living room, and bedroom can be set up to teach about home hazards (fireplaces, kitchen appliances), or to let children practice responding to a simulated fire, with ringing smoke alarms, doors that are hot to the touch and must be kept closed, billows of non-toxic smoke that must be crawled under, windows and ladders for emergency escape, telephones for rehearsing 911 calls (many children don't realize that there will be a person, asking them questions, at the other end of a 911 call). Users say they've saved lives. —MKS



This is a tremendous tool. I wish every department could have one. —Kathy Sawyer Shishida (Fairfield, California Fire Department)



WORKING ALONE
Tips & Techniques for Solo Building
 John Carroll. 1999; 152 pp. \$17.95. Taunton Press.

Build a house singlehanded? Of course it's possible, but who will move the other end of the board or ruler when

you yell, "Over an inch to the left and mark it, will ya?" How will you raise the 250-lb. roof ridge beam and live to tell about it? You'll need more arms than Shiva.

This book supplies those arms and hands in a very experienced how-to-think-about-it, nicely illustrated with drawings of useful devices—many easily made on the job site—

and associated procedures. We are talking jigs, brackets, and clamps (lots of clamps), and a bit of simple arithmetic. Mostly, the author helps you to develop an appropriately ingenious attitude, one that can be exported to other lonely enterprises.

—J. Baldwin

“ In addition to fine-tuning the sequence of the job, you have to plan just about every

step along the way. Often you even have to plan how you're going to do minor chores like safely sawing sheets of plywood or installing long boards. Sometimes these plans require a careful setup or some clever site-built rig. At other times, the plans are focused on subtle aspects of your technique. Starting a nail before you pick up a board, for instance, can make installing that board a lot easier. The process of anticipating problems and then visualizing smooth, effective ways to overcome them is at the heart of working alone.

“ While building walls is a very manageable affair for one person, raising them is a different matter. Walls are large and heavy and, until they are safely braced, can be quite dangerous. There are three different ways to get past the obstacle of raising walls when you're working alone. The first is to call in reinforcements. On many occasions I've scheduled a crew of workers to stop by my job on their way home from other jobs. When they arrive, I have the wall built,

squared, sheathed, and ready to tilt into place. We can usually get the wall up and securely braced in about 15 minutes.

Another way to get the wall raised is to build it in manageable sections that you can lift into place yourself. To keep the wall light, I wait to install the sheathing. When the wall is up and secured, I install the sheathing from the outside of the house....

The third way...is to use the proper rigging. Like an auto mechanic who thinks nothing of removing an 800-lb. engine, one carpenter can easily raise an 800-lb. wall—as long as he has the right equipment. A good tool for this job is the Proctor Wall Jack, which is made specifically for raising wood-frame walls.

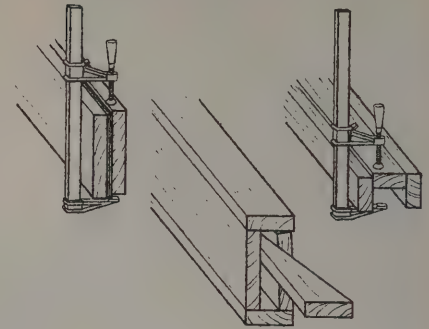
LASER LEVELS by J. Baldwin

You see their beady red eyes at most every job site these days. Are they really better than a traditional bubble level, chalk snap line, or water level? Yes, yes, & yes.

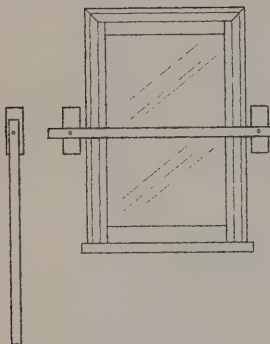
You can stand one on a tripod in the middle of a foundation layout and mark every stake and batter board within one-eighth inch of level by rotating the laser beam. No assistant needed.

Indoors, some models spin so fast that there appears to be a red line at the preferred height all around the room. Others project a brilliant vertical plumb line on walls and posts, or an exactly located spot on the ceiling, permitting perfectly aligned

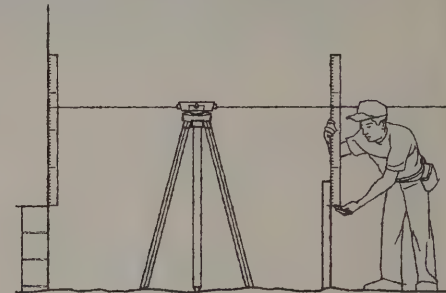
Techniques for Straightening Lumber



Above, left to right: Using a bar clamp to align the parts of headers; using a wedge to drive a twisted 2x10 into alignment; using a bar clamp to pull the bow out of a 2x4.



This bracket holds the window securely in the opening but allows you to move the unit from side to side as you fine-tune the installation.



FROM WORKING ALONE

walls, wallboard, and plumbing. Some can measure distances, too. All singlehanded.

OK already. Which is the best? Wееееllll, it's a relatively new field, without much long-term experience. Well-known brands may be as good as their reputations, or they may be under new management and no longer as wonderful. Unfamiliar brands could be fly-by-night or the most advanced technology available. You can pay from \$200 to \$2,000 for devices of apparently similar capability. I'd give the models in your price range a test try at a reputable contractors' supply store, and look for a good warranty.

ROBOLASER™

About \$200–\$275 at builders' supply stores. Toolz Inc., Mountain View, CA. 800/984-0404 or www.robotoolz.com for dealers and online sources.

I first tried a spirit level by Stabila, which you set yourself, relying on your eye. Then I switched to the RoboLaser, which uses a gravity device to self-level. I found it to be faster and more accurate. It stays in adjustment, and can be radio-operated, making for a truly one-man operation. For a builder like me, I think it's the best in its price range.

—Mike Gaspers





THE NEW AUTONOMOUS HOUSE

Brenda and Robert Vale. 2000; 256 pp. \$31.95. Thames & Hudson.

Twenty-five years ago, the authors proposed a modest house of ordinary amenity, to be largely built and sustained from local resources, and independent of the various supply “grids.” It was to use the sun and wind, and be heavily insulated and nonpolluting—all idealistic good stuff that seemed so logical and easy to accomplish back then. They wrote a book about their dream: *The Autonomous House*. It sold well.

Unlike many folks of similar mind, they actually built their dream house (in the early 90s, in a small town in the British Midlands), and have kept track of its energy and resource consumption since. *The New Autonomous House* chronicles in (occasionally tiresome) detail their thoughts and research as they philosophized, researched, pondered, battled, and compromised their way to reality. Like many records of such adventures, their story is simultaneously edifying, heartbreaking, and inspiring.

What I conclude from their findings: The obstacles and choices involved in building an autonomous house haven’t changed much since the 70s. It can be done, and it all works OK, but we still have a lot to learn before such houses—based as they are on 200-year-old technology—are widely accepted.

I’ve seen many books on this subject, but none so well documented and honest. —JB

“It was intended to make use of bricks from a reasonably near source in order to reduce transport energy demand....It was also the aim to find bricks that had a low embodied energy from their manufacturing process....The final factor that weighed in favour of these particular bricks is that they were made in a brickworks which uses the gas from decomposing garbage to fire the kilns, offsetting the use of North Sea gas. The brick company removes the clay from the ground to make the bricks, and rents the

PIT BOSS

\$159 postpaid (3’ deep); \$189 postpaid (4’ deep). Victorian Postman, 5027 W. North Avenue, Suite 101, Milwaukee, WI 53208. 414/445-2692, www.thepitboss.com.

For digging holes three to four feet deep (which is deeper than two-handle posthole diggers), and for a wider hole than soil bucket augurs. It’s a classic design reborn from around 1900. You can order their video first, and see how pulling the short lever pivots the shovel blade upward with less frustrating fallback of loose dirt. I don’t know how well it functions with cobbly and gravelly soils, but for gardens and ergonomics it’s a relief from repetitive shoulder stutters. —PW (Suggested by *HortIdeas*.)



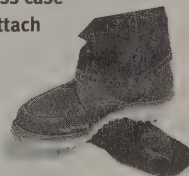
resulting holes to Barnsley Local Authority for use as landfill sites for refuse.

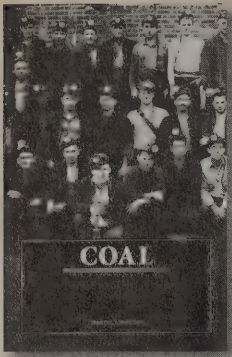
“The tank on the west side of the cellar has, in addition to the rainwater input and the connection to the other three tanks in the row, an overflow pipe leading from it....The inner end of the pipe, at the tank, is capped with a perforated stainless-steel plate, 6 mm thick, to obviate the possibility of rats coming up the overflow pipe and entering the water tanks. The purpose of connecting the four tanks together was to ensure that any excess of rainfall would be able to overflow to waste without flooding the cellar.

EFAS-CASE™ “INDESTRUCTIBLES”

\$31–\$37, with a money-back guarantee. Darling Products, 9035 S.E. Bobwhite Street, Hobe Sound, FL 33455. 800/99darling, 707/664-9399.

I wear my “indestructible” eyeglass case vertically on my belt (you can also attach it horizontally or from a loop). About half the time, security agents at the airport ask to look inside. It’s definitely prominent, which helps me make sure I haven’t forgotten my glasses. But the best part is you can step on the case and not go “oh shit” to the sound of cracking lenses. Not for everyone, but good when biking, building, digging, or if you worry your pack may bounce down a hillside. There are eyeglass, mini-binoc, cell phone, and compact camera “indestructibles,” all built to withstand 100 lbs of pressure. Varied colors. —PW





COAL

A Memoir and Critique

Duane Lockard. 1998; 225 pp. \$29.95. The University Press of Virginia.

I know pretty much what a farmer does, and I can imagine what life on a fishing boat must be like, but that forever dark world under the earth was almost a blank page until I read this book. Now I can picture the people who, right now, are working down there

under sometimes dreadful, unsafe conditions. True, they've come a long way from the times when, in Europe, slaves, and later, men, women, and children as young as five years old spent their brief lives in the ink-black darkness of the mines, but even now it's no day at the beach down there.

Duane Lockard has written a fascinating book—part personal account, part reference, in which he tells just about everything you'd care to know about the coal industry. He recounts his own beginnings in a West Virginia mine and provides an overview that encompasses the explosions, cave-ins, black lung, irresponsible corporations, politicians

for sale, fires, strip mines, unions (at their best and worst), mountains reduced to poisonous rubble, stream pollution, and the never-ending struggle to get safety, health, and environmental laws enacted and enforced.

Nearly a billion tons of bituminous coal is still produced annually in the United States. Most of it is burned to generate electrical power, in spite of increasing public concern about the dangers of global warming.

Following Duane Lockard's rise, from life in a company town to becoming a World War II Air Force pilot and then a professor at Princeton, makes good reading. And it gives us a lot to think about, particularly in this year when we must pick a new president.

—Malcolm Wells

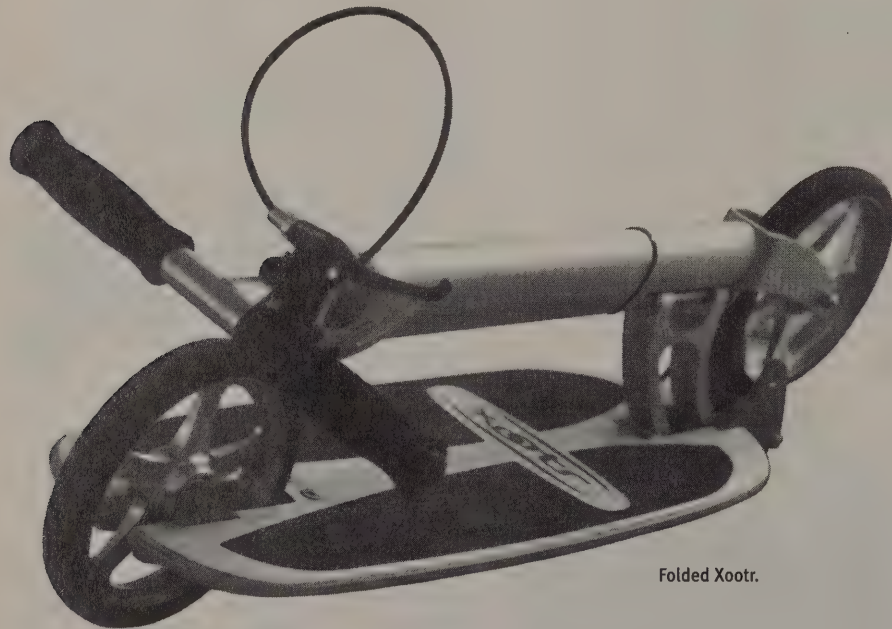
“ My first nights with a shovel in hand were highly educational. And as weeks turned into months I kept on learning and widening my awareness of the abundant mysteries of the underground world. I had long known, for example, of the difference between “machine coal” and “pick coal”; I knew the union contract called for a bonus of a

few more cents per ton for pick coal, which involved a lot more time and work because it had to be dug out entirely by hand. I am certain, however, that I had no conception of the danger of “stumping out,” the final stage of what is known as “room-and-pillar” mining. By observation I began to grasp a salient fact about the relationship between mine managers and miners: one was there to drive the other to take chances with life and limb in order to maximize output per unit of compensation.

“ Pictures at the Pit Mouth

When first black diamond lumps were found

Beneath the ancient Appalachian ground
A scene that none expected to see
Became as common as common can be
Stunned, the crowds quietly assemble
Kinfolk gather, watch and tremble
Waiting, waiting weary hours
Near the silent tippie towers
Against all odds they vainly hope
Some miner will walk that blackened
slope...



Folded Xootr.

XOOTR SCOOTERS

\$269 to \$489 at action-sports stores. Nova Cruz Products (Palo Alto, CA). 888/353-4464, 603/868-3705, sales@novacruz.com, www.xootr.com.

Orange crates nailed to roller skates, these aren't. They're designed (and priced) for adults and teens. The first high-performance folding kick scooter, the Xootr (pronounced “zooter”) is a very hot item in our

parts right now, for both play and urban transportation. With extremely low rolling resistance from wheels made by molding polyurethane onto aluminum centers, this scooter is fast, fun, effective transportation. It's less hassle than a bike for short trips. It folds in five seconds to the size of a skateboard; you can carry it with you or stash it under a desk or in a locker. Xootr has the



flex of a skateboard for quick maneuvering, and hand brakes like a bike's. I recommend the basic birch deck for \$269. The pricier models boast decks made of machined aluminum or carbon fiber. Wear a helmet!

—Stefan Gutermuth



THE CARBOHYDRATE ECONOMY

Katherine Mullen, program director.
\$35/year (4 issues).
 Institute for Local Self-Reliance,
 1313 Fifth Street SE,
 Minneapolis, MN
 55414. 612/379-3815,
 michelle@ilsr.org,
 www.ilsr.org.

The newsletter touting the superiority of plant-based over

petro-based products—and simultaneously expanding farming to become a community-based, “carbohydrate-based” economy with many more products: milk-based paints, bioplastic forks, corn-based aviation fuels, sugar cane plywood....The Institute for Local Self Reliance bursts forth with green plow jockeys taking on the fat cats of black gold. And it’s all very complex. The carbohydrate economy may perpetuate sugar cane and its pollutants, and GMOs, and soy nerf balls. It could increase degradation of what are now conservation lands on farms, or simply

switch perverse subsidies from corporate petro biz to corporate ag biz. But this fine newsletter has no illusions. Excellence, intelligence, and information are of the highest order. —PW

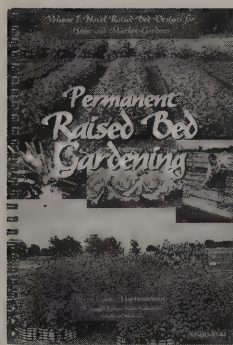
“At the top, a carbohydrate economy is being driven by officials reacting to environmental crises: the water quality crisis, resulting from MTBE, and greenhouse gas emissions, resulting from the burning of fossil fuels. At the bottom, a carbohydrate economy is being driven by farmers reacting to economic crisis of agriculture. For those at the top the goal is to expand the market. For those at the bottom, the goal is to change the structure of agriculture to allow farmers to earn an adequate income. Both are seeking to build a sustainable economy. The challenge is to link these approaches with a comprehensive strategy that strengthens rural economies, enhances farmer security, and protects the environment.

“The history of biodegradable plastics is marked by high expectations

and deep disappointments. Since the late 1980s a battalion of bioplastics ventures have been started with much fanfare, only to fold quietly a few years later....

...The bioplastics industry has had to overcome two major obstacles. One is their product’s high cost: two or three times that of petroleum-derived plastics. The marketing hook for bioplastics has been that they are biodegradable. But false claims of biodegradability in the past and a lack of a widely accepted and credible degradability standard have undercut the public’s trust. Still fresh in consumers’ minds are memories of the 1989 fiasco, when Mobil Co. made a line of Hefty bags that it claimed would break down in a landfill. Within months, Mobil was sued by seven states for false advertising. The bags, made of polyethylene with a cornstarch additive, disintegrated into plastic particles in sunlight and did not degrade at all in a landfill....

...But the times may be changing for bioplastics.



PERMANENT RAISED BED GARDENING

Volume I: Novel Raised Bed Designs for Home and Market Gardens
Volume II: Advanced Cultural Techniques for Home and Market Gardens
 Steve Upson. Vol. I, 72 pp., Vol. II, 49 pp. Free (Vol. I also downloadable from Web site).
 Samuel Roberts Noble Foundation, PO Box 2180,
 Ardmore, OK 73402.
 580/223-5810, www.noble.org.

Steve Upson and his colleagues at the Noble Foundation have invented a money-saving technique for making raised growing beds surrounded by rubber “boards” recycled from discarded tires. The rubber boards make much more environmental sense than treated lumber boards, and can result in considerably less total cost for beds. The books give design and construction details.
 —HortIdeas

Also great access to other topics such as soil solarization, fertigation (fertilizing through the irrigation system), plastic mulch application, tensiometers, and bed layout.
 —PW

“To produce a rubber board using this design, select a group of tires having similar tread width.

Next, remove the sidewalls using a jigsaw.

Make one cut through the tread on each tire using a power hacksaw. This produces sections of tread 5 to 7 feet in length and 6 to 8 inches in width, depending on tire size.

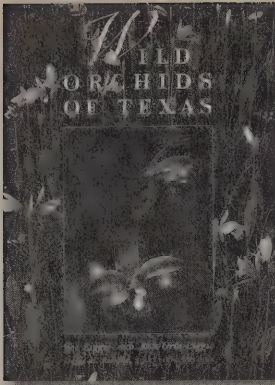
Based on the length of board needed, arrange the appropriate number of tread sections on your work bench end-to-end, making sure tread is facing down. Working from one end, slide the second section under the first section 6 inches and secure with four sheet metal screws. To ensure a strong union, place a screw in all four corners of the overlapped sections of tread, being careful to not get too close (within 1 inch) of the edge.

—VOLUME I

“Plastic mulches have been available since the 1960s....In addition to commercial growers, countless numbers of backyard gardeners have come to appreciate the many advantages plastic mulch provides, [including]... • Earlier crops • Weed control • Reduced evapotranspiration • Reduced fertilizer leaching • Cleaner product. —VOLUME I



Top: Recycled tire beds constructed on 5-foot centers. Each bed is 40 inches by 30 feet.
 Bottom: Using an “ell” fitting to connect the drip irrigation system’s main line and emitters.
 —From Volume I.



WILD ORCHIDS OF TEXAS

Joe Liggio and Ann Orto Liggio. 1999; 228 pp. \$29.95. University of Texas Press.

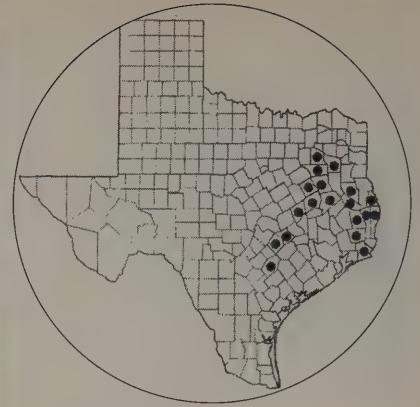
The best thing about a book like this is that by looking at a small, specific group of (wonderful, fascinating) plants you begin to learn about different kinds of habitats and the ecology of place. Without even noticing,

you start to get a real feel for what is going on around you. Any book that can do this is a good book, and this one is exceptional.

Wild Orchids is a remarkably thorough and clear-headed book displaying true enthusiasm and love of the orchid family. It describes each of the fifty-two species and two varieties of orchids that inhabit Texas with interesting orchid information as well as thoughts on wild orchid survival and how you can help.

Texas is divided into ten natural regions; the orchids are further mapped by county, so that you get a clear idea of what to look for where. Photos are plentiful and really good. Blooming times, history, and pollinators are noted for each species. So if you're not already in Texas, go visit your long-lost uncle, and take him out for an orchid walk before you settle down in front of the barbecue plate. —Mary Nisbett

“Some may believe they cause no harm to native orchid species when they buy them from commercial growers. Native orchids are offered by some commercial nurseries with the assurance that none have been collected from the wild. However, many times, wild-collected plants that remain in a nursery for only one growing season are then sold under



Left and distribution map above: The rose pogonia has from one to three lovely rose pink to white flowers. Each bloom emerges just above a separate leaflike bract near the top of the stem.

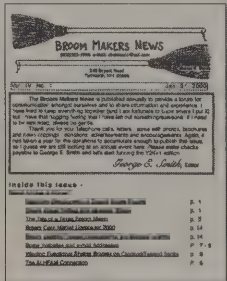
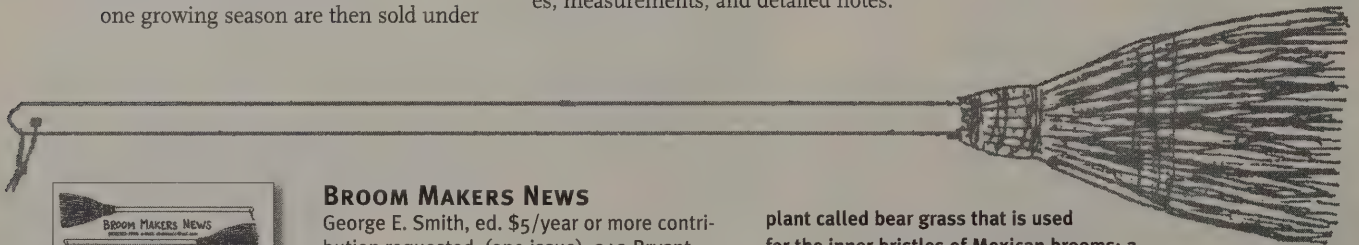
It grows in the acidic soils of wetland pine savannahs, in hillside seepage bogs, and on the edges of baygalls, mainly in the Pineywoods region.

In his poem “Rose Pogonias,” about finding a meadow with a thousand rose pogonias, Robert Frost described the air as “stifling sweet/With the breath of many flowers....”

the claims of being “nursery grown” (a practice called “nursery laundering”).

...Unenlightened botanists who collect specimens for herbariums can also contribute to the decline of rare orchid species. Although it is important to document new locations for rare species, all unnecessary collecting should be avoided, especially when only a few individual plants are found. Although collecting has little adverse effect on common orchid species, it can have a devastating effect on species already in peril. Alternatives to collecting, for purposes of scientific documentation, include photographs, sketches, measurements, and detailed notes.

“Charles Darwin, in *Various Contrivances by Which Orchids are Fertilised by Insects*, was the first writer to document the incredible number of seeds produced by a single orchid flower. Darwin estimated that a single pod of the European *Orchis maculata* produced more than 30 seedpods containing 6,200 seedpods each, for a total of approximately 186,000 seeds. However, this is a modest number compared to the capsule of the tropical *Maxillaria*, with its 2 million seeds.

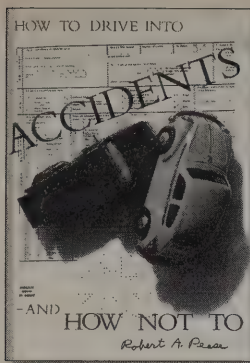


BROOM MAKERS NEWS

George E. Smith, ed. \$5/year or more contribution requested (one issue). 249 Bryant Road, Tamworth, NH 03886. 603/323-7926, shakeracc@aol.com. (Suggested by *HortIdeas*.)

Brooms au naturel. Access to broomcorn, wood handles, twine, whisk broom design, broom-maker machines, books, museums, dehumers. “Straw” brooms are still a major industry in nearby Mexico. Arizona, for instance, is now befuddled by the export of a

plant called bear grass that is used for the inner bristles of Mexican brooms; a minor tiff in the NAFTA saga, except if you love desert grasslands. Can broomcorn brooms ever compete with plastic bristles? Maybe not, but so what; this neo-Luddite newsletter favors elegant craft broomers. For someone like myself who finds meditative pleasures in sweeping, I'll spend a few more shekels to whisk away all that scuzz and dreck with my plant-based broom. —PW



HOW TO DRIVE INTO ACCIDENTS

And How Not To

Robert A. Pease. 1998 (reissue ed.); 472 pp. \$18.95. Pease Publishing.

Robert Pease looks like a madman and may be a genius. He carries his papers in a cardboard box. He laughs frequently; sometimes the proximate cause of his laughter is unclear. He shakes hands by way of expressing agreement. He

raises his eyebrows to express astonishment and pulls little tufts of his hair straight up.

He has an Old Testament beard. He is an honored employee of National Semiconductor, for which he “invents circuits and designs ideas.” They send him around the world. His conversation leaps from the cemeteries of Buenos Aires to the problems of home electrical wiring.

His expertise in the latter is unquestioned: he is the distinguished author of *Trouble-shooting Analog Circuits* (Butterworth-Heinemann, 1993), now in print nine years with 30,000 copies sold. In the old phrase: For the people who like that kind of thing, this is the kind of thing they'd like.

He's also the author of *How to Drive Into Accidents*. He sent me the book many months ago; I loved it. It is opinionated, repetitious, smart, provocative, loony, pedantic, and useful. It is probably the only automotive book with a cover blurb by Otto von Bismarck: “Fools you are...who say you like to learn from your mistakes...I prefer to learn from the mistakes of others, and avoid the cost of my own.”

I asked Pease about his mistakes. “Oh my! Oh my! Chapter 16! I have driven into trees. I have driven into trucks. If people read my book, they will not be as stupid as me. That is my guarantee.” He crosses his heart, liter-

ally. Then he claps his hands above his head. It's like talking to Moses during his tenure as a yell leader.

The prose of *How to Drive into Accidents* has a definite home-hobbyist feel. It has illustrations by the author. It has anecdotes. It has many, many opinions, some more conventional than others. It's all about driving, not a heavily covered topic in literature outside DMV manuals.

I wanted to write about the book when I first got it, but it turned out that it was really not available anywhere. It was self-published and essentially undistributed, except for the free copies to press people.

I was the only press person who even responded; discouraging for the author. But...Pease holds up a copy of *The Self-Publishing Manual* by Dan Poynter (Para Publishing, 2000). “This is the book,” he said, unaware of the duty of the author to hold up his own book when he says that. “Poynter knows more than everyone else put together.”

He got Baker and Taylor, a national distributor, to handle the book. He got support from the folks at Green Apple. He persuaded Amazon to list the book, an enviable coup. He is less impressed with the *Books in Print* people, who declined to list him, even though his book was clearly in print and for sale.

“I have sent them a strongly worded note. You have to wonder whom they are protecting.” The way he says it, you do begin to wonder. The Trilateral Commission? The House of Hanover? The Mongolian Hegemony?

The full Pease experience is available at www.transtronix.com. The book itself may even help you drive more safely, which is sort of the point. Unless the point is Pease himself, who flourishes in defiance of convention and has a swell time doing it. —Jon Carroll (© *San Francisco Chronicle*; used with permission)

“ There are several roads in San Francisco that are fun to drive. Gough St. has synchronized lights, and it's fun to try to keep moving despite slow traffic. Some city “parkways” are kinky roads, quite challenging. One friend recommended Titus Street in San Diego, as it is essentially a paved cliff. “It was always a thrill to drive over the edge, given that you could see nothing below as you went over. Local authorities decided that teenagers were having too much fun there, so they put a Stop sign just before the edge. However, people continued to crash and burn rather often, so they finally added a telephone booth at the bottom of the hill, so local residents would not be required to call tow trucks or ambulances.”

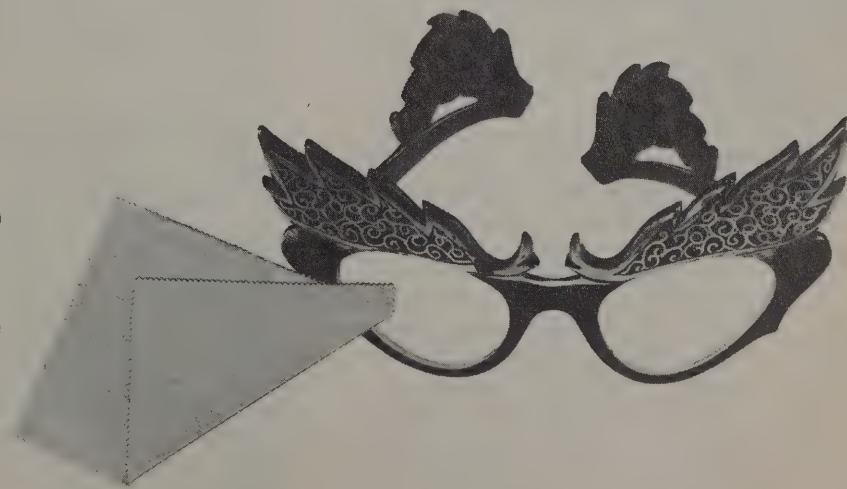
“ It is not SPEED that kills, but SPEED DIFFERENCE. If most of the drivers are doing 63 mph on a 55 mph road, and one guy is poking along at 41, the wise policeman will not stop the guys at 63, but will stop the guy doing 41 and ask him why. He will try to get that slow driver out of there—put him on the Old Road, or demand that he get his engine fixed, if it will not go any faster, or lock him up if he is drunk. But the guy doing 41 is the real danger to safe driving, because other people are not expecting to have to pass such a slow driver. (If you ever drive a slow car, or a heavy truck, you know that there are some high-speed highways where you cannot pick up speed—such as on upgrades. If you ever have to drive slower than 45 mph on a high-speed road, turn on your 4-way flasher signals, so people will be cautioned that they will have to pass you).

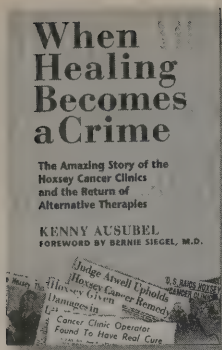
MIKROS

Microfiber Cleaning Cloth

Manufactured by Crystal Optical (Garden Grove, CA). Single orders (\$3.50) available from Tucson Audubon Society, 520/629-0510.

Here's what we bird-watchers use to clean our binocs and my friend photographers use to clean their lenses (it's the softest, most absorbent, etc.). You too can use it to clear your eyeglasses. Trust a guy who tries to see sparrows in dust storms and always puts his grimy fingerprints on the optics. —PW





WHEN HEALING BECOMES A CRIME The Amazing Story of the Hoxsey Cancer Clinics and the Return of Alternative Therapies

Kenny Ausubel. 2000; 461 pp.
\$19.95. Inner Traditions.

Despite being involved in alternative medicine (specifically homeopathic medicine) since 1972, I have always been strongly skeptical of alternative therapies for cancer. I

questioned their true effectiveness; even more, I questioned the ethics of their advocates. After reading Kenny Ausubel's newest book, I realize how effective the propaganda against alternative cancer therapies has been on me.

I was truly blown away by *When Healing Becomes A Crime*. What *Silent Spring* did for the environmental movement, this book does for the alternative cancer therapies movement.

The misinformation and demonization of alternative medicine by the AMA and the FDA is quite remarkable and sad (no, Saint-John's-wort won't cure this depression!). This McCarthyization of alternative healers didn't simply destroy people's lives as McCarthy did. It also led to the earlier death of hundreds of thousands of people by foisting upon them—as the only appropriate treatments for cancer—the notoriously ineffective and dangerous primitive radiation and chemotherapy of the day.

This book details the experience of Harry Hoxsey and his herbal formulas. Hoxsey was arrested more than a hundred times in one two-year period, and hundreds of other times before and after this, although his leading nemesis, AMA leader Morris Fishbein, acknowledged under oath that Hoxsey's therapy was indeed effective in treating certain types of cancer. Fishbein's statement never changed his heavy-handed efforts to make access to Hoxsey's treatment difficult or impossible. Hoxsey's clinic was forced out of the US and into Mexico in the early 1960s; it has continued to provide care for people since Hoxsey's death in 1974, but is still not allowed into the US.

This book is riveting. It can and will lead to fits of anger at orthodoxy's impressively effective PR efforts to turn successful spokespersons for alternative medicine into quacks and criminals. This book is also extremely well referenced, with both historical records and modern scientific literature. The amount of scholarship that went into writing it is admirable. —Dana Ullman

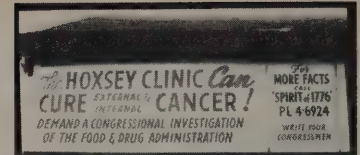
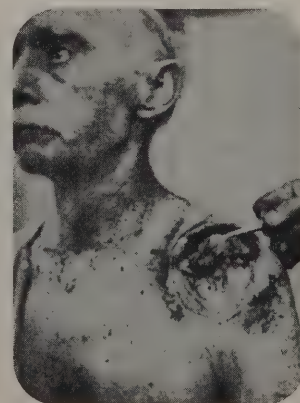
Right: This tumor dried up, and was removed, after treatment by Dr. Hoxsey. The AMA attributed the cure to prior surgery and radiation treatment.

“ Under California's new anti-quackery laws in 1959, it became a crime to treat cancer with anything but surgery, radiation, and the emerging chemotherapy. The only exemption was for religious beliefs and prayer since [California Attorney General Caspar] Weinberger had Christian Scientists in his family....The restrictive California laws were soon adopted by other states....

As the 1950s drew to a close, the government crackdown was nearly complete. It had taken the full power of the state apparatus to eliminate Hoxsey and the host of other unorthodox cancer practitioners from the medical playing field.

“ Until the 1950s orthodox medicine viewed cancer purely as a local disease. Doctors sanctioned only surgery and radiation as effective treatments, both being localized approaches reflecting their belief that tumors were independent growths on an otherwise healthy organism. After decades of taking the position that “there is no known liquid medicine which cures internal cancer,” orthodoxy acknowledged a systemic approach with the development of chemotherapy drugs in the 1950s. Even then, the exclusive orientation was to kill cancer cells by using strong poisons.

To the contrary, Hoxsey and the lineage of natural medicine he espoused characterized cancer as a *systemic* illness...“which occurs only in the presence of a profound physiological change in the constituents of body fluids and consequent chemical imbalance of the organism. Its real cause must be sought in the basic body chemistry and cell metabolism. We believe that the organism's attempt to adapt itself to the new and abnormal environment causes certain mutations in newly born cells of the body. Eventually a viciously competent cell evolves which finds the new environment eminently suitable to survival and rapid

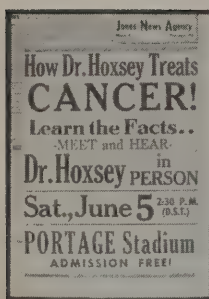


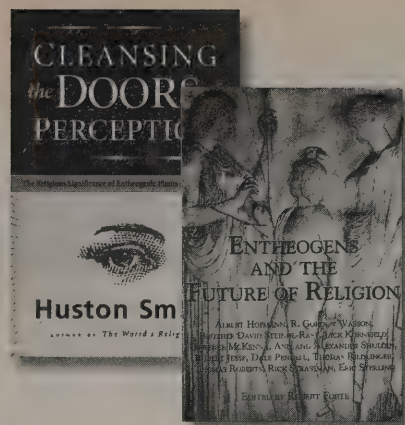
self-reproduction. These cells are what are known as cancer.”

Hoxsey believed that a systemic approach could remedy the imbalance. “It follows that if the constitution of the body fluids can be normalized and the original chemical balance in the body restored, the environment again will become unfavorable for the survival and reproduction of these cells. They will cease to multiply and eventually they will die. Then if vital organs have not been too seriously damaged by the malignancy (or by surgery or irradiation), the entire organism will recover to normal health. We attempt to get at the roots of the disorder, rather than deal merely with its end result. Our primary effort is to restore the body to physiological normalcy.”

“ For decades organized medicine ridiculed the Hoxsey remedies as a bunch of “weeds” and refused to look into them. Typifying this kind of cavalier dismissal was a classic 1940s archival medical film we located called *Fraud Fighters*. Cast in much the same style as the heavy-handed antimarijuana propaganda film *Reefer Madness*, the melodramatic movie relates the parable of “Elixerex,” an ersatz nostrum in a thinly disguised Hoxsey-like tonic bottle. Under the *Dragnet*-style narration, the movie follows Elixerex through the FDA's 1950s state-of-the-arts labs, which today look as archaic as the era's Univac computer. Elixerex lands in the blocky hands of grim, square-jawed junior G-men intent on rounding up the unscrupulous crook behind the scam. The medical ideology is as black and white as the film footage.

“ Internal correspondence between the AMA and news organizations revealed carefully scripted programs designed to discredit Hoxsey, with copious back story supplied by the Bureau of Investigation....After Hoxsey appeared on a public debate on KCOP-TV in Los Angeles, a member of the AMA legislative committee suggested he would speak to friends in Congress about having the Federal Communications Commission revoke the station's license.





ENTHOGENS AND THE FUTURE OF RELIGION

Robert Forte, ed. 1997; 183 pp. \$15.
Council on Spiritual Practices.

CLEANSING THE DOORS OF PERCEPTION

The Religious Significance of Entheogenic Plants and Chemicals

Huston Smith. 2000; 173 pp. \$22.95.
Jeremy Tarcher.

The Council on Spiritual Practices (CSP) continues to produce good books in a field that is too often neglected. *Entheogens* (about “psychoactive sacraments”) includes thirteen pieces by such authors as Ann and Alexander Shulgín, Terence McKenna, Albert Hofmann, and this reviewer. Topics cover mysticism, the Eleusinian Mysteries, current scientific studies, and the legal status of religious freedom regarding entheogenic substances. CSP’s important “Code of Ethics for Spiritual Guides” is included in an appendix.

In one essay, Thomas B. Roberts notes: when unorthodox ideas appear in books, governments censor books; when unorthodox ideas are transmitted through experience, governments censor the experiences.

Before he took mescaline with Timothy Leary in 1961, eminent religious historian Huston Smith was convinced of the truth of the mystical viewpoint, but says he had never experienced it. CSP’s latest book, *Cleansing the Doors of Perception*, presents Smith’s writings on revelatory plants and substances in the forty years after that experience. He says that entheogens are not a shortcut, but an encouragement that can occasion life-changing experiences even in those with no interest in mysticism. He notes that when religious scholars were given randomized descriptions of mystics’ experiences and entheogenic drug experiences, they were unable to distinguish between them.

The book includes an interview and eleven essays, slightly revised, with new introductions, including the seminal “Do Drugs have Religious Import?” and “Psychedelic Theophanies and the Religious Life.” In the latter, in 1967, Smith suggested that psychedelic theophanies are not likely to have

substantial staying power, for three reasons: a flawed social program, “antinomianism” (believing you can lay aside secular laws for higher or deeper truths), and too little regard for the esoteric/exoteric divide (the notion that some revelations should be secret).

Some of the arguments are dated, but the questions are not. Under “a flawed social program,” he quoted Leary: “Quit your job. For good...Quit school. For good.” But it is imprecise to equate the religious thrust of sixties LSD use with Leary’s “drop out” program, a program that is even less relevant today. Nevertheless, isn’t changing one’s career and lifestyle what Smith asks for elsewhere—“not religious experience, but the religious life”? The religious life depends on what one drops *into*, after dropping *out*, and the new life for many centered on community, social and ecological activism, and spiritual practice. The reverberations are still manifest.

Smith said that if the psychedelic community were apocalyptic, revolutionary, or utopian, it would have presented an alternative, but he believes it was none of these. I disagree, but am content to let another fifty years reveal which of us is right. No religion emerges full-grown. The failure of some “antinomian” religious experiments of the sixties was perhaps due less to flaws in moral theology than to violent and legal suppression while they were still emerging.

Smith recently contrasted uncontrolled psychedelic use in the sixties with today’s “responsible” entheogenic use, implying that “uncontrolled use” is irresponsible. Without minimizing unethical incidents (such as giving LSD to unwitting persons, whether by the government or others), I maintain that, for the most part, self-administration of LSD in the sixties was profoundly responsible. Given the times (a suffocating, moralistic, and conformist paternalism, a bloody and useless war, and mostly deaf ears among our nation’s elders), the highest responsibility of a young citizen was to seek vision.

Several million Americans who took LSD alone, with their lovers, in small circles or large groups, devoted lives and dreams to spiritual awakening. If there was dereliction, it was in those who saw the vision and chose not to rock the boat. It was unlicensed—even licentious—use of LSD by a significant fraction of an entire generation that gave America a glimmer of hope for a more tolerant, creative, and cooperative society. And the work continues.

Idealistically believing we could usher in an Aquarian Age of Love was perhaps naïve, but was not, and is not now, irresponsible. We want an entheogenic peace—for everyone. We want our prisoners released—our friends and benefactors, our dealers and chemists, our children.

As to the “esoteric/exoteric divide,” I offer the words of Lew Welch: “Guard the Mysteries. Constantly reveal them.”

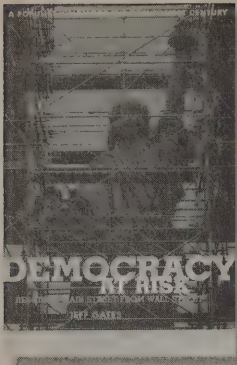
I argue with Huston Smith every time I talk to him, and every time I write about him. I always enjoy it immensely. He tackles the most cogent questions. Congratulations to CSP for bringing these essays back into print and bringing Huston Smith back into the dialogue. —Dale Pendell

“ If one believed that human nature was basically evil, that altered states weakened one’s defenses against evil, that the Kingdom of God was not within, that the world was basically a frightening and dangerous place, then would psychedelic experience magnify these expectations and produce a truly hellish trip? Perhaps entheogens are best left to members of transcendental denominations. On the other hand, would entheogens constitute religious enrichment for the transcendently deprived? Looking at the chapters in this book, the answer looks like “yes.”

—THOMAS B. ROBERTS IN ENTHOGENS

“ The fully realized human being is one whose doors of perception have been cleansed—I have myself referred to these doors as windows and envisioned them as successive layers of our unconscious minds. Those that are near the surface vary from person to person, for they are deposited by our idiosyncratic childhood experiences. At some level, though, we encounter the Three Poisons (once again: desire, aversion, and ignorance) that are common to humankind and to some degree may be necessary for us to function as individuals. But the deepest layer, I have suggested, is really a no-layer, for—being a glass door ajar, or a mirror that discloses other things rather than itself—it effectively isn’t there. Even if it were there, in what sense could we call it ours? For when we look toward it we see simply—world. —CLEANSING

“ It should not be assumed from what I have written that the experience was pleasurable. The accurate words are significance and terror...We have it on good authority that no man can see God and live—the sight would be too much for the body to withstand, like plugging a toaster into a power line. I thought of trying to get up and walk across the floor. I suspected that I could do so, but I didn’t want to risk forcing this intensity of experience into my physical frame. It might shatter the frame. —CLEANSING



DEMOCRACY AT RISK Rescuing Main Street from Wall Street (A Populist Vision for the 21st Century)

Jeff Gates. 2000; 368 pp. \$25.
Perseus Publishing.

It's so easy to get pissed off at capitalism. But most of the time, people who feel oppressed by capitalism—by indifferent corporations, corrupt campaign financing, or global monopolization—aren't drawing a sharp enough distinction. The problem isn't

business, per se, but the rules of the business game, and in particular the (mostly) unconscious venality of the wealthiest property owners on the planet. Most of them aren't corporations, but rich individuals and families who use corporations to shield and mask their property. In writing about their disproportionate wealth, why it evolved into such abusive excess, and the impact that has on democracy and community, Jeff Gates broaches the last great taboo of our time. But he goes further; drawing on his political and economic background (as an aide to populist Senator Russell Long, a staffer on the Senate Finance Committee, and a longstanding proponent of alternative stock ownership plans),

he proposes a comprehensive package of remedies. Some are grassroots initiatives like indigenous credit. Some require large-scale policy shifts. They all start with making capitalism a participative process, not just through meaningless speculation like day-trading, but through ingrained community involvement in corporate action.

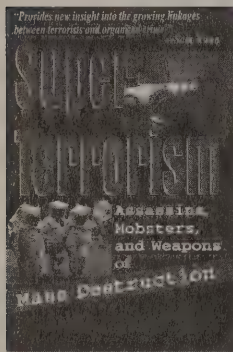
The inherent murkiness of political finance has been exacerbated by 100 years of legal and accounting extra-murkiness. Jeff Gates brings it down to earth. But if you're still struggling, a good companion is Kurt Vonnegut's venerable novel, *God Bless You, Mr. Rosewater*. Vonnegut writes about the "money river"—the gushing rapids of concentrated wealth that few people ever get to see. Jeff Gates shows how to open up the dams and let the river flow. —Art Kleiner

“Financial markets are a commons, not unlike a commonly shared pasture where all the residents of a village graze their cows. No one owns the pasture, yet each profits from its use. No one owns the financial commons, yet theoretically at least, everyone benefits from it. There's a reason, after all, that we use the term "securities" to describe stocks, bonds, and other financial instruments:

Their security is due largely to international treaties that underwrite the worldwide enforceability of property rights—from which a remarkably small proportion of the world's population pocket the bulk of the financial benefits.

...Should those who benefit from this global commons contribute to its upkeep? It's largely their livestock that are fattened up in this pasture. If that seems a fair and reasonable proposition, then the next question becomes: Should that fee be paid in cash or in kind?

“Taxes, like subsidies, are a feedback loop. Taxes signal us to use less; subsidies tell us to use more—whether it's subsidies paid to tobacco growers, the under-pricing of irrigation water, the Forest Service selling sixty-five-foot lodgepole pines for \$2 each, or taxes we choose not to levy on hydrocarbon use....The question is whether tax policy is designed to end today's illusion of cheap, abundant natural resources while labor (heavily taxed) appears quite dear. At present, we've got our signaling backward.



Superterrorism Assassins, Mobsters, and Weapons of Mass Destruction

Glenn E. Schweitzer with
Carole C. Dorsch. 1998;
363 pp. \$28.95. Plenum.

Perhaps it's just my long-running suspicion of government power in general, but I've tended to resist getting too worked up over the years by scare stories about terrorist threats. I've had better things to worry about than

nuclear bombs in suitcases, and besides, I've been more than a little annoyed by how often my belt buckle seems to set off overly sensitive security detectors at airports.

Hence, I was initially inclined to dismiss a book with a title like *Superterrorism: Assassins, Mobsters, and Weapons of Mass Destruction*, as just more propaganda for expanded police powers. Not so. Glenn Schweitzer soberly surveys the growing overlapping of terrorism among radicals, drug runners, mafiosi, and fringe sects, and offers both copious examples of past incidents and realistic projections of future possibilities. Perhaps it is just the sheer accumulation of details at work, but I came away from this

book with the unhappy realization that things are likely to get worse before they get better.

The back cover blurb that claims this book "reads like a spy novel" may be overblown, but I wouldn't hesitate to recommend this serious book to anyone wanting to get a handle on just what kind of threat the mutating underworld of terrorism really poses.

—Jay Kinney

“The days when the economic crimes and money laundering of the drug dealers, the mafia, and the robber barons were not tied to terrorism are over. With hundreds of billions of dollars at stake every year from the drug trade alone, the deadly interlinkages among groups with different agendas but with common tactics of violence are evident around the world. Indeed, the narcotics industry is the greatest generator of terrorism in some countries. Drug profits arm rural, guerilla and urban gangs, promoting corruption that destroys democracy and renders law enforcement agencies impotent. The marriages of terrorists and traffickers have become daily ceremonies. Arms traders, drug runners, and money laun-

derers will happily support terrorist campaigns in their ignoble pursuit of profit.

“There are over twenty thousand specialists throughout the Russian nuclear complex whose knowledge of weapons would be of considerable benefit to rogue states or terrorist groups trying to enter the nuclear weapons era....These specialists know how to design, assemble, and test weapons. They are expert in producing the highly enriched uranium and plutonium that provide the explosive power. And they know which approaches will not work under any circumstance, having already been in and out of blind alleys for many years.

Most of them, perhaps fifteen thousand, are located in the ten formerly secret atomic cities whose rundown conditions mirror many of the problems in Snezhinsk. Paychecks are low and erratic, and much of the current activity at the institutes is best described as busy work....Unemployed workers have few incentives to continue to diligently serve the state. They may not be paid at any given time. Drinking is on the rise, and theft and street crime may have



TOO MUCH
 A Quarterly Commentary on Capping Excessive Income and Wealth
 Sam Pizzigati, ed. \$15/year (4 issues).
 Council on International and Public Affairs,
 Suite 3C, 777 United Nations Plaza,
 New York, NY 10017. 800/316-2739,
 cipany@igc.apc.org. Included free with
 membership (\$25) in United for a Fair
 Economy, stw@stw.org, www.stw.org.

SHIFTING FORTUNES
 The Perils of the Growing American
 Wealth Gap
 Chuck Collins, Betsy Leonard-Wright, and
 Holly Sklar. 1999; 94 pp. \$6.95. United for a
 Fair Economy (see above).

On December 3, 1997 Michael Eisner cashed in his \$565 million Disney stock option. One hundred laborers stitching 101-Dalmations T-shirts for Disney in Mexico would have to work their eleven-hour shifts (at fifty-seven cents an hour, with two bathroom breaks a day) until the year 5000 to match Eisner's one-day windfall.

If that's the sort of item you like to drop at cocktail parties, or at your plutocratic uncle's dinner party, or during a break at union negotiations, in order to display your knowledge of inequity in America, then pick up a subscription to *Too Much*. It's America's only newsletter dedicated to the proposition that "the United States would be a far more democratic, prosperous, and caring nation if we narrowed the vast gap between the very wealthy and everybody else."

Each issue is packed with facts and statistics about the scandalous spread between the wages of ordinary working Americans and the CEOs of the companies that own the companies where they work. Names are named, along with salaries, bonuses, stock options, and golden parachutes—all of which appear to expand inversely to the competence and performance of departing executives; the more you lose for your company, the bigger your severance.

The twelve-page newsletter is also spiced with boardroom gossip, alongside some

hilarious accounts of executive spending habits. Yes, you can buy a bottle of wine (1900 Chateau Margaux) for ten grand. And with the market booming, they've been moving by the case. If you're a teetotaler, you can pop over to Bijan on Fifth Avenue and pick up a sports coat for \$14,000. It's made of python skin. —Mark Dowie

Shifting Fortunes covers the same territory, with less flair but more data: page after page of charts, graphs, and stories documenting the rush of wealth across a chasm separating asset owners from wage earners and family farmers. But where, runs one subtext, is the revolution that such gross inequity should have fomented? —MKS

“Once upon a time, few CEOs in the United States were flying any higher than Lawrence Coss. Between 1992 and 1996, this mobile home-finance king took home paychecks worth \$216 million—\$102 million in 1996 alone.

The secret to this success? Coss's company, Green Tree Financial, routinely charged low-income families interest rates two to three points above mortgage rates for conventional homes.

But life was going to sour mighty fast for Coss. In 1997, Green Tree had to admit huge accounting blunders that forced Coss to return \$26 million of his \$102-million pay.

...The accounting mess eventually threatened Green Tree's corporate viability, and, last year, Coss had to put his beloved company up for sale.

But shed no tears for Lawrence Coss....For starters the 59-year-old Coss will stay on the payroll as a consultant, through June, at a \$92,000 weekly rate. He'll also pocket \$30 million in severance. —Too MUCH

“How does one put together a democracy based on the concept of equality while running an economy with ever greater degrees of economic inequality? At some point, those who are losing economically have to use their political power to vote in a government that reverses the outcome of the market. No one knows where this point is. In the United States, there have now been over 25 years of rising inequality in income and wealth with no observable political backlashes. Perhaps our society could move much farther along the continuum toward inequality; perhaps not. But it is a stupid society that runs an experiment to see where its breaking points are.

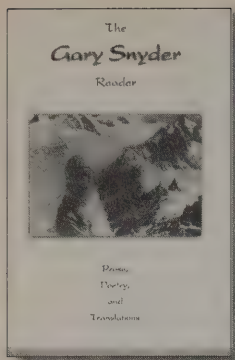
—SHIFTING FORTUNES

penetrated the high fences. Schemes that border on illegality are slowly becoming methods of choice to compensate for personal hardships resulting from reduced subsidies. With secrets being the most valuable commodity, the situation poses a serious threat.

Below, left to right: Agents of terrorism, from conventional to superterrorist—“Carlos the Jackal,” freelance terrorist of the 1970s and 1980s; Shoko Asahara, responsible for the Aum Shinrikyo cult's nerve gas attack on the Tokyo subway in 1995; Richard Pryce, British hacker who broke into US Air Force computer systems; spores of anthrax (*Bacillus anthracis*).



	1970s	1980s	1990s
MOTIVES	PRIMARILY POLITICAL	POLITICAL/RELIGIOUS/ECON.	ECONOMIC/POLITICAL/REL.
TARGETS	•Key Political and Industrial Leaders	•Western Civil Aircraft •Western Industry •Judicial Systems •National Leaders	•Financial Centers and Systems •Transportation and Energy Infrastructures •Judicial and Media Individuals
METHODS	Hostages, Hijacking, Bombs, Small Arms, Ransom, Blackmail	Like 70s, plus Semtex, Large Truck Bombs, Chemical Weapons	Like 80s, plus Information Warfare, Potential Weapons of Mass Destruction, Potential Missiles
SUPPORT BASE	Palestinian, Marxist	Add Militant Islam	Add Organized Crime



THE GARY SNYDER READER

Prose, Poetry, and Translations 1952–1998.
Gary Snyder. 1999; 617 pp. \$35.
Counterpoint.

Except for Gary Snyder, post mid-twentieth century American poetry might never have gotten further out-of-doors than the nearest garbage dump, golf course, or cat-fish farm. And despite his protégés, Snyder probably remains the poet who's ground away the most sole tread hiking through

wilderness. That happy-dog, defining-moment grin Ginsberg caught in his cover photo of a younger Snyder high among rocky, snowy peaks tells it all: utter exhilaration at unexaggerated altitudes.

If you're reading this, you already know if you want the book. It is, as Jim (*Fup*) Dodge says in his introduction, a "Greatest Hits," along with both new and newly published prose and poetry, plus the *East West Journal* and *Paris Review* interviews.

Most aging poets just grow old; without mocking the term or the man, this one can be recognized as an elder. He knows stuff we'd like to know, and he's positioned himself to be one in whose presence learning is possible. Heartwood. It will burn through till dawn. —William Pitt Root

“ After twenty years of walking right past it on my way to chores in the meadow, I actually paid attention to a certain gnarly canyon live oak one day. Or maybe it was ready to show itself to me. I felt its oldness, suchness, inward-

ness, oakness, as if it were my own. Such intimacy makes you totally at home in life and in yourself. But the years spent working around that oak in that meadow and not really noticing it were not wasted. Knowing names and habits, cutting some brush here, getting firewood there, watching for when the fall mushrooms bulge out are skills that are of themselves delightful and essential. And they also prepare one for suddenly meeting the oak. —FROM *A PLACE IN SPACE*

“ Now in the nineties desert night
—my lover's my wife—
old friends, old trucks, drawn around;
great arcs of kids on bikes out there in the darkness
no lights—just planet Venus glinting
by the calyx crescent moon,
and tasting grasshoppers roasted in a pan.

—FROM "FINDING THE SPACE IN THE HEART"

INCH BY INCH

45 Haiku by Issa
Nanao Sakaki, trans. 1999; 73 pp.
\$12. La Alameda Press.

LET'S EAT STARS

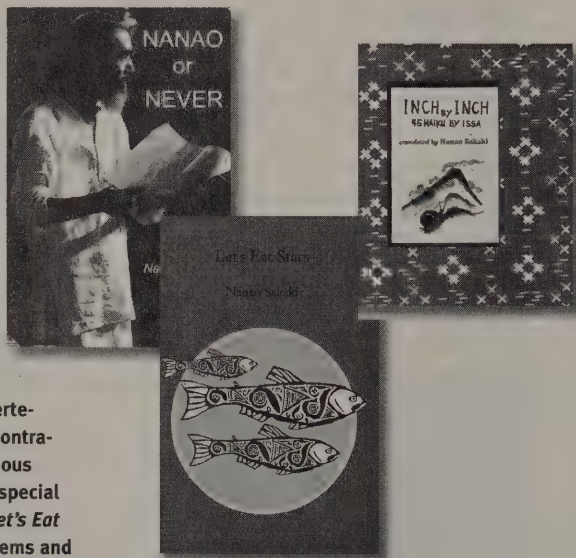
Nanao Sakaki. 1997; 142 pp.
\$11.95. Blackberry.

NANAO OR NEVER

Nanao Sakaki Walks Earth A
Gary Lawless, ed. 2000; 260 pp.
\$16.95, Blackberry.

Three by Nanao (*Whole Earth*, Summer 1997). *Inch by Inch* is translations of Issa's haiku. Very invertebrate (snails, cicadas, crickets) and contraposed to those many other very serious academic haiku translators. Nanao's special sport: a disarming hayseed humor. *Let's Eat Stars* is his second compilation of poems and plays, after *Break the Mirror*. *Nanao or Never* is a backpack full of stories by friends who love him.

Once a Buddhist monk lathered Nanao with the monk's long, honorable lineage. Nanao answered: "I have no lineage. I am desert rat." Nanao's poetics cut through the clutter, chatter, and the misplaced concreteness of modernity. He is Japan's ninja Earth walker, tripster, spirit warrior, and elder poetic voice; haunted by Hiroshima and Nagasaki. Disarming poetics, deceptively "simple" subversions and word carvings crafted from Ainu, "primitive," and other ancients' merriment. (Think of the best breeze at the best dawn of your life). —PW



“ Let's Eat Stars

Believe me, children!

God made
Sky for airplanes
Coral reefs for tourists
Farms for agrichemicals
Rivers for dams
Forests for golf courses
Mountains for ski resorts
Wild animals for zoos
Trucks and cars for traffic tragedies
Nuclear power plants for ghost dance.

Don't worry, children!
The well never dries up.

Look at the evening glow!
Sunflowers in the garden.
Red dragonflies in the air.

A small child starts singing:

"Let's eat stars!"
"Let's eat stars!"

—LET'S EAT STARS

“ Upon the blooming plum twig
a warbler
wipes his muddy feet

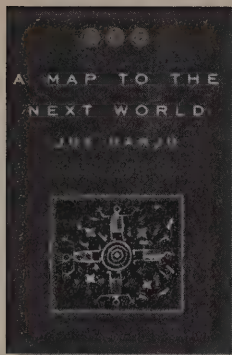


How lovely
through the torn paper window
— the Milky Way



Grasshopper, good singer!
Take care of my tomb
when I die

—INCH BY INCH



A MAP TO THE NEXT WORLD

Poems and Tales

Joy Harjo. 2000; 138 pp. \$22.95. W.W. Norton.

This is in many ways the best collection yet from one of our strongest poets—and one of the tiny handful who, faithful to Rilke's most difficult directive, have never raised a shield of irony or cynicism to prevent a direct hit to the heart. Her recurrent themes

include the traumas of love and fear. Both personal and political, she emphasizes the function of courage for keeping the spirit honest and vital.

Her fourteen-part anchor poem, "Returning from the Enemy," unblinkingly explores the complexities by which abuse, alcoholism, and an ultimate grace are braided into an umbilicus no rational understanding can sever. It reads like a hymn, like a song of praise, with all the lurid ambiguities of moaning heard through a motel wall. Alternating riffs of free verse and prose, keeping the constant ground beat of emotions taut, she obliquely advances the narrative. The force of her clarity is startling, the power of her rhythms, disarming.

Disarming is one thing Joy Harjo is always about, turning even the most heartbreaking demolition into a difficult truth/beauty fusion, at once grave and ecstatic. Read her.

—William Pitt Root

“The Ceremony

All my life I have entered into the ceremony from this door, toward the east into red and yellow leaves.

It has always felt lonely though there were always messengers, like the praying mantis on my door

when I opened it this morning. Or the smell of pancakes when there were no pancakes, coffee when there was no coffee.

I walked through the house we had built together from scraps of earth and tenderness, through the aftermath of loving too hard.

You were showering to get ready for war; I was sticky from late storms of grief and went to look for poetry.

Each particle of event stutters with electricity, binds itself to coherence.

Like the trees turning their heads to watch the human participants in these tough winds turning to go, as they continue to send roots for water making a language for beauty out of any means possible though they are dying. Everyone is dying. I am I am, deliberately and slowly of this failure to correctly observe the ceremony of letting go ghosts of destruction. I walk carefully through the garden, through the hallway of sobbing and laughter, the kitchen of bread and meat, the bedroom of desires and can see no ghosts though they will take the shape of objects of ordinary living.

There is no poetry where there are no mistakes, said the next messenger. I am a human being, I said.



YOU CAN'T WIN

Jack Black. 2000 (reprint ed.); 340 pp. \$16. Nabat/AK Press.

You Can't Win is the autobiography and apologia of Jack Black, a burglar-turned-librarian, an opium-smoking "reconstructed yegg" who robbed from the rich and the not-so-rich for no redeeming social reason, then turned honest too late to squeeze into the social fabric of his times.

Published in 1926, the book documents the life of a pre-depression, post-Jack London, con man and sneak thief whose shenanigans were successful because the routine use of deadly force was not incorporated into the law enforcement codes then. Try some of Jack's tricks today and you will be blown into bits of frown and gristle.

This is an exciting book, full of jailbreaks and murder in the hobo jungles and plenty of how-to tips for the aspiring felon. Woven throughout the tale is a plea to those on the top of the pile to help the grifters and grafters and ex-cons and prostitutes find a place in society instead of in jail. Good advice to a nation where incarceration has become a very big business. —J.D. Smith

“While waiting on appeal the great earthquake and fire occurred. All the records in my case were destroyed. I could not be sent to prison, and the attorney could not get me out, so I became a permanent fixture in the county jail.

The old Broadway county jail was a stout structure and resisted the quake, but was fire-swept and abandoned. When the fire threatened, all prisoners were removed to Alcatraz Island and later to the branch jail at Ingleside. I was there over six years and the things that happened there during that time would fill a book.

During the graft prosecution that followed the fire, Ingleside housed the mayor, the political boss of San Francisco, and many of the supervisors. A looting banker was there, many strikebreakers indicted for the murder of union men during the car strike, and soldiers for wantonly shooting down citizens while the city burned. Jack Johnson, the colored heavyweight champion, was with us for thirty days for speeding.

Money was plentiful in the jail. The grocer came every day and we all got enough to eat. The political boss bought

many books and founded a library. He also got a big phonograph that was kept going all day and far into the night. I was "appointed" jail librarian, and at once catalogued the books and installed them in an empty cell.

The jail was a cross between a political headquarters and an industrial plant. The political prisoners did politics, and prisoners whose records were burned in the fire turned to industry.

We got contracts to address envelopes and sublet the work to others. We sewed beads on "genuine" Indian moccasins for a concern downtown. Best of all, we bought cheap jewelry from mail-order houses and sold it at a profit to visitors, giving them to understand that it was stolen stuff we had smuggled in with us.

“I kept it [burglary] up for years, and quit it only because I got tired of playing the peon for crooked pawnbrokers and getting "fifty fifty" from the professional "fences." The fences' notion of "fifty fifty" is to put a lead dollar in the Salvation Army tambourine and ask the lassie for fifty cents change.

LETTERS

Whole Earth is a conversation. Compliments, cavils, and corrections are welcome. Letters and e-mail may be (reluctantly) edited for space or clarity.

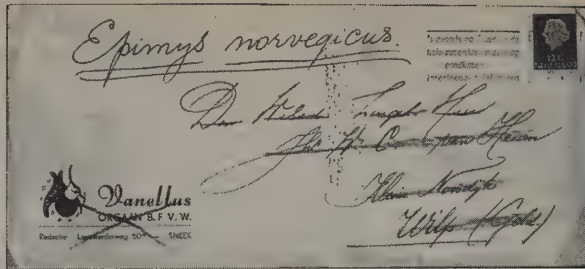
The Real Green Parties

The “Greens”—those trying to make a dent in the two-party system—are ever plagued by the extreme-left/Bookchin anarchist group of a few hundred members known as “Green Party USA.” Alas, the press always confuses their Left-Green platform (e.g., abolish the US Senate, tax the rich at 100 percent) with ours. Also, when Web browsers go to GreenParty they get THEM and think they’re US!

“Us” is the Associated State Green Parties, the organization of state-level Green Parties (in twenty-four states so far), with hundreds of thousands of members. It was at our convention in Denver (not the tiny splinter group’s earlier convention in Chicago) where Jim Hightower nominated Ralph Nader as our presidential candidate, and he accepted. Our Web site is www.gp.org. Nader has his own Web site: VoteNader.org.

Cheers,
Charlene Spretnak
Moss Beach, CA

[See Charlene’s “How About That Green Option?” in *Whole Earth*, Summer 2000 —Ed.]



Flattened mole mailed to Willem van Heurn, in original envelope, with Latin name written at top. Photo by Rosamond Wolff Purcell, from *Finders, Keepers* (see page 55).

Intersex Interlocution

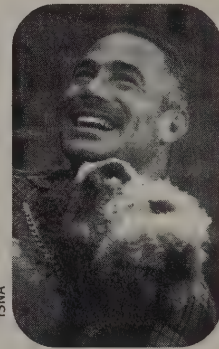
Dear Dr. Bruce Bagemihl,

I write in regard to your article in the Spring 2000 issue of *Whole Earth*. We share your interest in bringing to light evidence of the variability of sex in the natural world. However, we would like to update your knowledge of human intersexuality.

I am an intern at the Intersex Society of North America (ISNA). ISNA is a leader in a growing social justice movement—our mission is to end shame, secrecy, and genital mutilation of people born with mixed sex anatomy. Intersexuality is fairly common; at least one in two thousand people is born with an anatomy that defies easy classification as male or female (see www.isna.org/frequency.html). Less extreme variations are considerably more common.

The photograph you [Not Bruce. It was *Whole Earth's* selection. Bruce had nothing to do with it. —Ed.] used

to illustrate intersexuality accurately reflects the medical view that intersexuality is a medical problem and



Howard Devore, Ph.D., was subjected to 16 genital surgeries while growing up. He is now a psychiatrist with much experience helping families deal with intersex issues.

that it is freakish, rare, and shameful. ISNA is working hard to replace such representations with pictures of real people without their eyes blacked out, and with their real names attached.

You [Again, *Whole Earth* wrote the caption, not Bruce. —Ed.] also write that “male pseudo-hermaphrodites are all very attractive ‘women.’” I think that you have confused the term “male pseudo-hermaphrodite” with the diagnosis of complete Androgen Insensitivity Syndrome (c-AIS). The term “hermaphrodite” is misleading and stigmatizing, and we are working to replace it with the less loaded term “intersex” (see www.isna.org/hermaphrodite.html). In addition, c-AIS is one of the rarer forms of intersexuality; the diagnosis “male pseudo-hermaphrodite” covers anyone with testes and some physical sexual ambiguity. These individuals have bodies that may look anything from female to ambiguous to male. See “Hermaphrodites with Attitude: Mapping the Emergence of Intersex Political Activism,” by Cheryl Chase,



“Hermaphrodites with Attitude” picketing the 1996 annual meeting of the American Academy of Pediatrics, who refused to meet with them.

ISNA

in *GLQ: A Journal of Lesbian and Gay Studies*, Spring, 1998.

On intersex, please refer to the ISNA Web site, www.isna.org. I encourage you also to consider purchasing our half-hour video, *Hermaphrodites Speak!* which can be ordered from the Web site.

Sincerely,

Mary Kelterborn. ISNA Intern
Ann Arbor, MI

Dear Mary,

I completely agree with you that the photograph included with the article and the accompanying caption were inappropriate! If I had seen them, I would have objected most strenuously to that photograph and its caption on exactly the grounds you indicate. Such images look very much like (in fact, some of them are!) medical illustrations, and including them would perpetuate the medical/pathological model of intersexuality that I am trying to challenge. Doubly so for pictures of intersexual people's genitals, which would be dehumanizing, objectifying, and not at all appropriate in my opinion.

While I cannot speak directly on their behalf, I do not believe that the editors of *Whole Earth* intended any disrespect. Peter Warshall and the magazine were otherwise remarkably sensitive, open, and responsive to the issues and communities discussed in the article. Indeed, their decision to publish this piece was a courageous and controversial one that not many other magazines would have taken on, and they were my first choice for placement of this article because of their track record for intelligently and creatively presenting important topics to a broad audience.

Elsewhere I have been an outspoken advocate and supporter of trans rights and I continue to speak out against medical models of intersexuality, against the pathologizing of transgender, and in favor of the right of gender-variant people to resist medical definitions of their lives and to determine exactly how much or

how little surgery and other biotechnologies to allow in their lives. See, for example, my "GenderTalk Radio" interviews with Nancy Nangeroni and Gordene MacKenzie (available on the Web at www.gendertalk.com/real/gt216.html); and my keynote address to the Ars Electronica 2000 Festival of Art, Technology, and Society (www.aec.at/nextsex), where I speak about the impact of new biotechnologies on lesbian, gay, bisexual, and trans people.

Cordially,

Bruce Bagemihl
Seattle, WA

Editor's comment: We goofed, because we tried too hard to explicitly show the manner in which intersexuality has been presented, but did not make clear that it was everything Mary and Bruce state. We tried to get acceptable and non-objectifying photos to counterbalance the "medical model," and could not find any. The two photos on page 100 are ISNA's choices.

Intersex Polar Bears?

I would like to say that I really enjoyed Bruce Bagemihl's article, which dealt with transgender issues in a very open-minded fashion. However, as much as I appreciated the message I feel that there were some inaccuracies. [Bruce wrote, "...scientists frequently attempt to pathologize homosexuality and transgender—for example by ascribing them to the presence of "pollutants" in the environment even when there is no evidence for such." —*Ed.*]

Polar bears eat a high fat diet in order to survive. Pentchloro-biphenyls (PCBs) are incredibly persistent manmade chemicals that have a high affinity for fat, and are thus within the food chain. PCBs have the ability

to mimic estrogen and other hormones in mammals. The seals that polar bears eat have PCBs, and thus the polar bears have PCBs. So while I would like to believe that there are pristine places on this planet where life has not been affected by anthropogenic activities, there are not. I believe that it detracts from the reality of how much of a crisis the environment is truly in when we perpetuate a myth that there exist pristine areas or ecosystems.

Thank you,

Dr. Jennifer L. Holmes
by e-mail

Get Off It. Hang in There. Inspire.

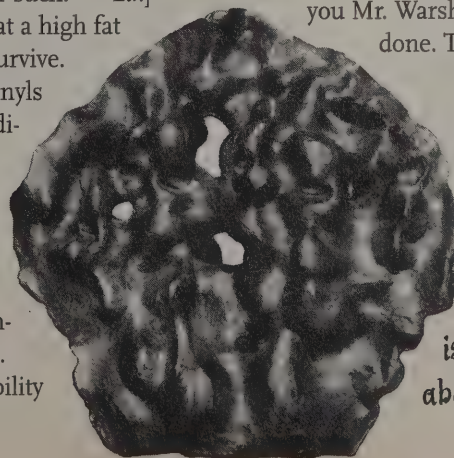
Sometimes it is easy for me to forget the most essential and important things and this loss of inspiration makes for soul-searching times. And then comes the next edition of *Whole Earth*. Reading your magazine never fails to inspire me. Reminds me to just get off it!

Reminds me that I am far from alone. Thanks to you all for hanging in there. Your work is appreciated.

Love and peace,
Mary Koopman
Tucson, AZ

We Like to Call It Postmod

You asked for money, property, assets, or something like that. Well, is it possible to donate a deficit instead of an asset? I've never had much success with selling clay sculpture. I hope you do. Let me know so I don't burden you more than once (if you aren't interested, that is). Thank you Mr. Warshall for magic well done. The color issues,



Untitled sculpture by Doug Stutes. For sale by *Whole Earth*. We'll accept bids until December 31. The piece is steel-blue color, clay, about 14" x 14".

from aerial photos to microscope photos, showed me how feeble my attempts are. Good luck with revenue raising. If the sculpture doesn't sell, they fill holes in the driveway pretty well. Again, let me know if you are not interested in my type of donations and I won't send any more. (Had a clay drum sent your way too.)

Thanks,
Doug Stutes
Lafayette, LA

Moments of Fame

As I am approaching 90, I was considering letting go of *Whole Earth*.

However, I remember the years when it was *CoEvolution Quarterly*. The founder, Stewart Brand, and I first met in San Francisco after the publication of a story I wrote, "The Great Gaming House." Brand had suggested it to Patricia Phelan as a theme for a fund-raising event. Some months later Ms. Phelan wrote to say that a fine site had been found, the Fireman's Fund building, and it was scheduled for September 24, 1983. As the time approached I complained as it appeared that I would never see the fulfillment of my dream. Soon an air ticket came to me, and soon I flew to the site...but it played for one night, only.

One hears of single moments of fame and I am more than satisfied with mine! As I say, "For one day all San Francisco danced to my melodies!" All of this may have happened seventeen years ago but is still fresh in my memory.

So...you will find my check, attached.

Kelly Yeaton
State College, PA

We remember *him* most fondly! His piece was so terrific we hunted him down. He got us to put on the *most* extraordinary and creative fundraiser I've ever been to (a benefit for Planetree) with over 300 volunteers (and alas just under 300 guests).

Ryan Phelan [formerly Patricia Phelan —Ed.]

UPDATES



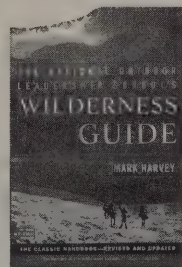
SMALL IS BEAUTIFUL
Economics As If People Mattered
25 Years Later...with Commentaries
E.F. Schumacher.
1999 (3rd ed.);
286 pp. \$19.95.
Hartley & Marks.

In this edition's introduction, Paul Hawken reports that the original 1973 *Small Is Beautiful* "became canon" at Portola Institute, *Whole Earth's* then-publisher. Schumacher enunciated premises—appropriate scale, voluntary simplicity, diversity, natural capital—that seemed self-evident once he articulated them, and looked like a basis for remaking economics and society. His vision spawned scores of organizations, and still serves as the grounding for much of the NGO movement attempting to redefine economics and society today.

But there's the rub. The ideas are still on the outside, opposing mainstream thinking. Why didn't they catch on more widely? Why does the book's title seem a little dreamy-eyed, evoking nostalgia for a 1970s optimism? Nearly three dozen contributors (half are *Whole Earth* contributors) explore such questions in responses that fill this reissue's margins. They explore the Schumacher legacy—where he proved prescient, where his ideas are at work today—along with asking what he missed, why existing structures resisted his challenge, and what work remains. They remind us that Schumacher, whose thought was deeper and richer than his title's bumper-sticker simplicity, remains worth reading and debating. —MKS

THE NATIONAL OUTDOOR LEADERSHIP SCHOOL'S WILDERNESS GUIDE

The Classic Handbook—Revised and Updated
Mark Harvey. 1999;
268 pp. \$15. Fireside.



Since 1965, the National Outdoor Leadership School (NOLS; *The Essential Whole Earth Catalog*, page 374) has offered highly regarded, if somewhat pricey, wilderness survival programs. The *Wilderness Guide* distills NOLS's wisdom about leave-no-trace self-sufficiency, from expedition preparation to equipment, travel and camping technique, expedition behavior, and emergency procedures. —MKS



VANISHING VOICES
The Extinction of the World's Languages
Daniel Nettle and Suzanne Romaine.
2000; 241 pp.
\$27.50. Oxford University Press.

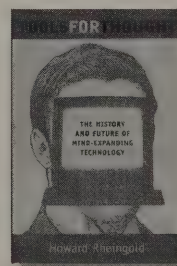
If *Vanishing Voices* had been available, we would

have included it in "disappearing languages" in our Spring 2000 issue. It documents global language diversity, and the threats to it, and argues that preserving local languages doesn't have to mean consigning their speakers to the economic and political margins. Rather, economic development, biodiversity, and linguistic diversity become interdependent parts of a single sustainability strategy that requires greater honoring of local knowledge and ways of life. The book is more theoretical than practical, with some helpful case studies. —MKS



YOUR PRIVATE SKY
R. Buckminster Fuller: The Art of Design Science
Joachim Krausse and Claude Lichtenstein, eds.
1999; 524 pp. \$65.
Lars Müller Publishers.

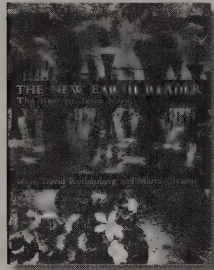
Fuller's star is rising as his discoveries are becoming mainstream (often without crediting him). His restored Dymaxion "Wichita House" is being reconstructed at the Henry Ford Museum in Dearborn, Michigan. A one-person play on his life and work played to rave reviews in San Francisco this summer. The deluxe *Your Private Sky* accompanies a European traveling exhibit of his work. Its writing is standard museum curatorese, formal and speculative, but the photos and drawings are the best I've seen. Let's hope the exhibit comes to the US soon. Until then, you can get the book. —J. Baldwin [author of *Buckyworks* (1996; Wiley), now in its third printing and soon to appear in Japanese]



TOOLS FOR THOUGHT
The History and Future of Mind-Expanding Technology
Howard Rheingold.
2000 (2nd revised ed.); 359 pp. \$17.95.
MIT Press.

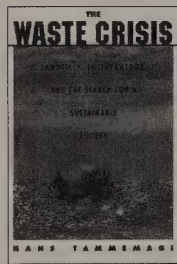
Tools for Thought appeared in 1985, before Howard became *Whole Earth Review's* editor. It remains the best introduction I know to the real history of personal computing (as opposed to the

couple-of-geeks-in-a-garage fable). The new edition adds a long afterward in which Howard interviews many of the pioneers profiled in the book. They meditate about what did or didn't unfold in the computer/human world they helped create, and ponder "Now what?" in response to both the enormous successes and the now-recognized limitations of mind-amplifying tools. —MKS



THE NEW EARTH READER
The Best of Terra Nova
David Rothenberg and Marta Ulvaeus, eds. 1999; 238 pp. \$24.95. MIT Press.

We were big fans of *Terra Nova* (*Whole Earth*, Spring 1999), the classy journal of literary musings on the connections between human culture and "the nature in all things." After publishing *Terra Nova* as a quarterly for three years, MIT Press turned it into a book series. This, the series' first volume, collects the best articles from the quarterly. David Rothenberg's interview with Jaron Lanier, "Ruby Crystal Squid Dancing on the Rings of Saturn," is alone worth the price of admission. —MKS



THE WASTE CRISIS
Landfills, Incinerators, and the Search for a Sustainable Future
Hans Tammemagi. 1999; 279 pp. \$29.95. Oxford University Press.

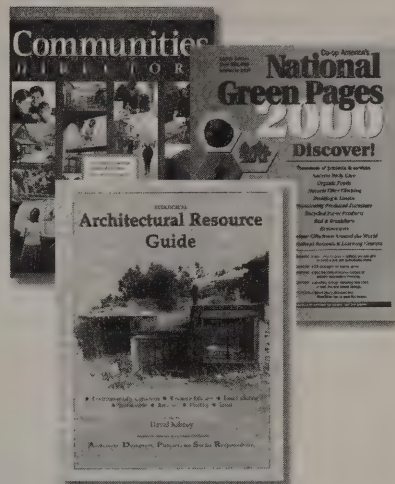
A realpolitik book on the need for recycling to reduce waste, landfills for what can't be recycled, and incinerators when appropriate. The best overview. It replaces earlier books, though its "balance" will not feel so to those worried about dioxins in emissions or leakage of leachate. —PW

SEPTIC SPACE

Jay Critchley, 7 Carnes Lane, Provincetown, MA 02657. 508/487-3684, rerooot@tiac.net.

We wish we had known, when we wrote our septic system reviews last issue, about *Septic Space*, an abandoned septic tank converted by artist Jay Critchley (*Whole Earth*, Winter 1997, page 55) into an art gallery/performance space. "Eugene O'Neill and the Provincetown Players had abandoned wharves for theaters in the early 1900s, we have abandoned septic tanks in the early 2000s....Let's keep the tradition alive!" —MKS

DIRECTORIES & ANNUALS



CO-OP AMERICA'S NATIONAL GREEN PAGES

2000; 216 pages \$5.95. Co-op America, 1612 K Street, Washington, DC 20006. 800/58-GREEN, www.coopamerica.org. Included free with membership (\$20) in Co-op America.

COMMUNITIES DIRECTORY

A Guide to Intentional Communities and Cooperative Living
Fellowship of Intentional Communities. 2000 (3rd ed.); 456 pp. \$30 (\$34 postpaid). Communities, 138 Twin Oaks Road, Louisa, VA 23093. 800/462-8240, www.ic.org.

ECOLOGICAL ARCHITECTURAL RESOURCE GUIDE

David Kibbey, ed. 1999; 250 pp. book or CD-ROM. \$35 postpaid (book and CD-ROM, \$50). Architects/Designers/Planners for Social Responsibility (ADPSR), PO Box 9126, Berkeley, CA 94709-0126. 510/273-2428, www.adpsr-norcal.org.

To be listed in the annual *National Green Pages* (*Whole Earth*, Spring, 1998), businesses must demonstrate that their practices improve the quality of life of their customers, employees, community, and planet. Besides thousands of product and service listings, the *Green Pages* offers green tips on working, saving, investing, and spending, and "true tales of responsible living."

The Fellowship of Intentional Communities (*Millennium Whole Earth Catalog*, p. 140) says we're living in the third great flowering of communities, following the student co-ops and pacifists of the 1930s and 1940s and the Flower Children communes of the 1960s and 1970s. Most intentional communities die within five years, but this third edition of the *Communities Directory* lists at least one dating from every decade of the twentieth century, and from every year since 1960. Along

with the scoop on more than 700 communities, the *Directory* offers dozens of essays about community living and a guide to resources.

The *Architectural Resource Guide* is organized around a standard building sequence, with essays on green practices at each step, followed by listings of materials, manufacturers, and distributors. The CD-ROM version is searchable and updatable, and includes additional listings from ADPSR's "Resource-Full Showcase" traveling exhibition and its "Building Less Waste" project. —MKS



VITAL SIGNS 2000

The Environment Trends That Are Shaping Our Future

Lester R. Brown, Brian Halweil, and Michael Renne. 2000; 192 pp. \$13. W.W. Norton, www.worldwatch.org.

THE STATE OF THE WORLD'S CHILDREN 2000

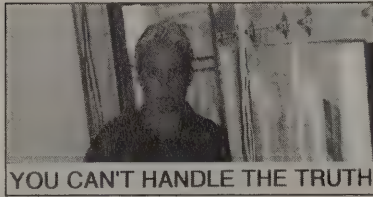
UNICEF. 2000; 120 pp. \$12.95 (\$17.95 postpaid). United Nations Publications, Sales and Marketing Section, Room DC2-853, Dept. 1029, New York, NY 10017. 800/253-9646, 212/963-8302, www.unicef.org/apublic/.

These reports (along with Worldwatch's *State of the World*; see *Whole Earth*, Spring 2000) are the planet's annual physical exam. *Vital Signs*'s data and charts for key indicators and features tell both good and bad news: declining numbers of refugees...increased stresses on amphibians...booming wind power...resurgent tuberculosis. One overall trend: disparity (in wealth, power, opportunities, and survival prospects) is up; diversity (in biology, economics, culture, and transportation) is down. *The State of the World's Children 2000* reflects on the years since the 1990 World Summit for Children. It reports "remarkable progress" on some of the Summit's goals, but concludes, "This has been a decade of undeclared war on women, adolescents and children." Page after page of maps, graphics, and statistics let you draw your own conclusions. Portions of both reports can be downloaded at the Web sites above. —MKS

GOSSSSIPPPPPP!!!!

PW: Here's gossip, unedited, by the staff. A reminder: if you buy reviewed books through our Web site (www.wholeearthmag.com), we have switched to independent bookstore Powell's, in Portland, Oregon. We get a small cut. It's a way to avoid the megasites.

Devon herself in one of her paste-ups tacked onto our office walls. Snapshot by the inquiring editor.



From Devon, concerning our new assistant editor: I feel for Emily Polk. After a couple years of writing and traveling the planet, she has lived here in the Bay Area, for, count them, four months straight. During our exciting (yes, that is sarcasm) bus ride over the Richmond Bridge, we play UNO (for the record: Devon 5; Emily 4) and trade stories. I tell her about horseriding with a friend and his mother down the beaches of Phuket (no, it is NOT pronounced that way! It is a beautiful island in Thailand!). Rather than galloping gracefully, as my hair flew in the warm breeze, the horse promptly sat down and tried to roll over on me. I leapt off and stood there, confused, while my friend's mother assumed, in a fit of panic, that her son had been crushed underneath. Emily counters with a riveting tale of camel riding in Africa...and I have totally lost my point.

Anyway, the addition of Emily as assistant editor has clearly livened up the energy in the office. Between us, young, wild women are slowly taking over, and the San Rafael office has quickly become the cool place to be. Where else can you find wild turkeys outside your window, and ceramic art that "can be used to fill pot-holes in the driveway" sent in by a reader (thanks by the way)? Adorning the walls are the cut-and-paste "artistic" masterpieces I create during quiet moments in my assistant publisher/advertising executive/circulation manager/assistant book-

keeper/office manager (nope, not stressed at all) schedule. Emily's one of those special people who doubles over, silently shaking, with tears streaming down her face, rather than gently giggling. Yep, she's a keeper. I have finally found my partner-in-crime to help ruffle the feathers of these aging birds.



We have big plans for the upcoming months, attending numerous conferences. If you're lucky enough to find this young female contingent from *Whole Earth*, tell us a story and renew your subscription. We'll let you play a hand of UNO with us, and we can definitely use the money.

From Mike on Nicole, J.D., and his godfather: We'll be missing senior editor Nicole Parizeau, at whose old desk Emily now sits. Nicole left to accept a position as senior science writer at the Lawrence Hall of Science in Berkeley. Nicole's precise editing, passion for research, organizational wizardry, and elegant presence raised the level of everyone's work. We wish her the best.

In far-flung correspondents news, *Whole Earth* author and raconteur J.D. Smith writes that he is managing a symphony orchestra, "...sorta like working for sixty Stewarts....I am surprisingly good at it, mainly because I cannot tell a maestro from the average Joe, and prefer the com-

pany of Joe. I think of myself as an arts plumber, fixing wounded or bulimic nonprofits. Pays about what tractor driving was paying. A little less dusty."

The Pendleton-based Oregon East Symphony, says J.D., is the most remotely situated full symphony orchestra on the planet. "*Mad Magazine* once did a piece called 'Amazing Facts' which stated that the moon is only one fourth the size of the Earth, yet farther away. The service area of the OES is about the size of Connecticut, yet farther away. I also work with the Walla Walla Symphony, which, entering its 94th season, is the oldest continuously operating symphony orchestra west of the Mississippi River, yet farther away."

One eerie moment for me this summer: Devon came in to ask what do with a letter from a Florida woman asking us to discontinue the subscription of her brother, who had died a few weeks before. I looked for a moment at the names and froze. Her brother was my godfather, Charlie. Charlie and my father had been Navy buddies. He lived alone in New Hampshire, and none of us in California had heard about his death (his sister had just retrieved his address book, and was starting to notify family and friends). Charlie used to pass *Whole Earth* to his town's tiny library after reading it. We've given the library a subscription in his honor.

Jay Kinney, acting publisher, wants to remind our readers: *Whole Earth* needs your help more than ever. If you prize the unique mix of vital information and human voices that *Whole Earth* brings, please consider assisting with a generous donation. *Whole Earth* is a 501(c)(3) nonprofit (and boy, is it ever nonprofit, believe me!). Donations are tax-deductible. Please help before 2001 and keep the campfire burning. **we**

Right: Emily Polk. Scribbled for the *Boston Globe*, *Central America Weekly*, *India Express*.... Globetrotter/trekker from Vermont to Turkey to the Himalayas. Here she is on a beach in Costa Rica with leather-back turtle that she watched being born that dawn.

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ISSUE 102 THANKS

We are grateful to the following people for editorial, art, and business assistance with this issue.

ALL SPECIES

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Roberta Faul-Zeitler (Assoc. of Systematics Collections)
Marian Farrior (The Biodiversity Project)
Jane Fisher (All Species Foundation)
Rodrigo Gamez (INBio)
Charles Greene (Goldman Fund)
Robbie Kaplan (Island Press)
Jack Longino (ALAS)
Mary Blue Magruder (Earthwatch)
John McCosker (Cal Academy of Sciences)
Scott Miller (Smithsonian)

Russ Mittermeier (Conservation International)
Emma Outlaw (Conservation International)
Nicole Parizeau (very much missing editor)
Ryan Phelan (All Species Foundation)
Sir Ghillean Prance (Kew Gardens)
Peter Salk (Salk Institute)
Stephen Sautner (Wildlife Conservation Society)
Peter Shannon (San Francisco Zoology Society)
Mathew Shepherd (Xerces)
Jennifer Smith (Cornell Lab)
Barbara Smuts (U of Michigan)
Sarah Wiegel (All Species Foundation)
David Western (Conservationist, Kenya)
Jeff Wilcox (Nature Conservancy)

HAWAI'I

Jody Van Aalst (The Island Bookshelf)
Kimo Campbell
Mayumi Oda (Great heart, great artist)
Pohaku Fund
Susie Rashkis
Bill Taylor (www.hawaiiibooks.com)

Donors since our last issue! Kristin Kennell; Edward Wolf; Peter Roberts; Alain Coupal; Bob Gotz-Greenwald; W.J. Rademaker M.D.; Roar Fyellheim; Peter Wehrli; J. Oosterlinck; Andrew St. John; Gary & Andrea Frankel; Richard White; William Wong; I. Kurgan; Nancy Weil; William Kint; Jonathan Cook; John McDonough; Richard & Jennifer Beers; Katherine Haven; Karen Kerner M.D.; David & Gisela Gamper; Mary Ellen Bates; Eric Podietz; Daniel Yount; Douglas Hurdelbrink; Alice Howard; Tary Lilly; Michael Wilson; John Clarke; Joshua Mailman; Marion Sweeney; Clair Killen; Joe Weisman; Greg & Mary Reynolds; Doug Weinfield; E.H. Mackay; Leslie Sweetnam.

*Announcing
the Margaret Mead 2001 Awards recognizing
community creativity for a new century*

from the Margaret Mead Centennial Committee, Institute of Intercultural Studies, and *Whole Earth*

**"Never doubt that a small group of thoughtful, committed citizens can change the world."
— Margaret Mead**

When Margaret Mead died in 1978, she was the most famous anthropologist in the world. In her honor, having started in 1999 and continuing through the centennial year of her birth in 2001, *Whole Earth* and Margaret Mead's foundation, the Institute of Intercultural Studies, come together to honor small groups of thoughtful, committed citizens who have changed the world.



Mead always believed in the human capacity to change, insisting that the cultural habits of racism, warfare, and environmental exploitation are learned. She promoted human diversity as a teaching tool; pointed to modified traditions and new institutions that had successfully adapted to a changing world; and praised groups who were inspirations, models, and vehicles for learning from one another. Her goal was nothing less than intercultural and international understanding as a foundation for human freedoms.

If you know of a small group (fewer than 100 people) anywhere on the planet that has worked to change the world; that has cross-connected issues such as race, environment, intergenerational learning, child rearing, and gender understanding; that has developed an organization or series of tools that others can learn from; and that takes a long view of cultural understanding, please send your nominations to:

Mead 2001 Awards PO Box 3223 Peterborough, NH 03458 or nominate@mead2001.org

GIVING TO WHOLE EARTH

Whole Earth is supported by many generous readers, friends, and foundations. We gratefully thank all those who have given. In particular, the people listed below deserve special thanks. *Whole Earth* is published by Point Foundation, a not-for-profit 501 (c)(3) organization. On behalf of the magazine, Point can accept appreciated stock, equipment, or other tangible assets as donations. Direct inquiries to Devon King at 415/256-2800, ext. 221; giving@wholeearthmag.com; or *Whole Earth*, 1408 Mission Avenue, San Rafael, CA 94901.

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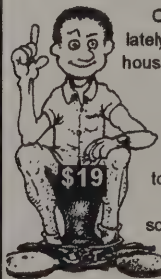
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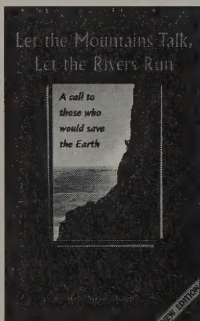
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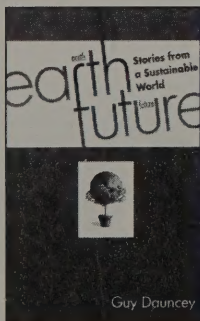


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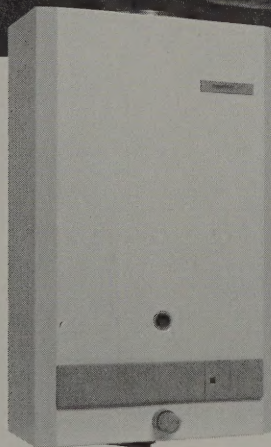


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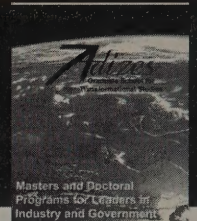
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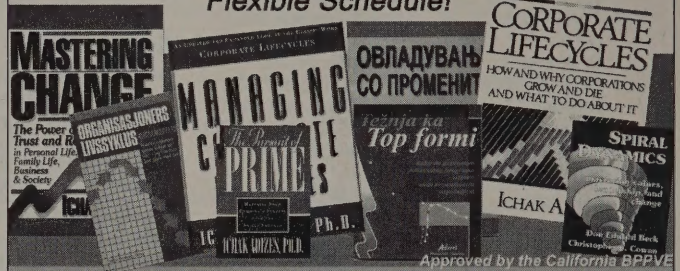


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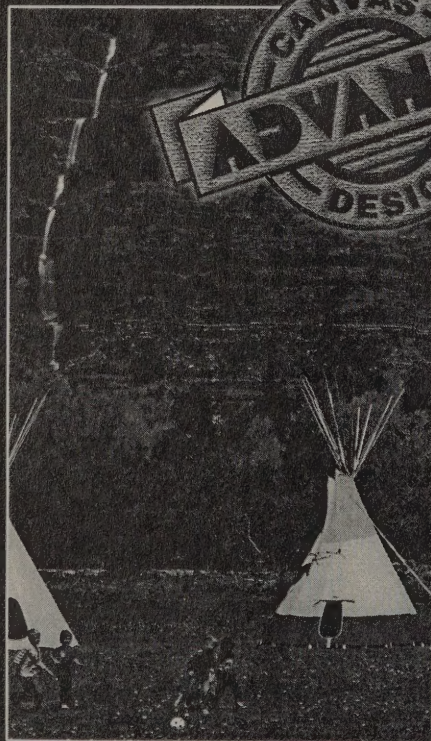
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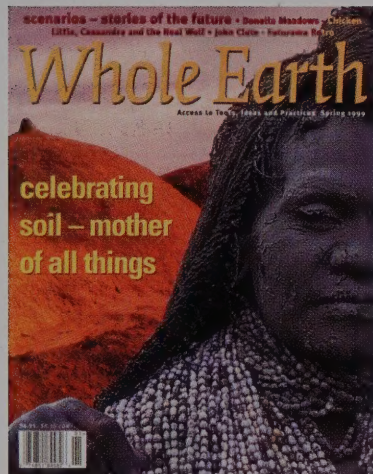
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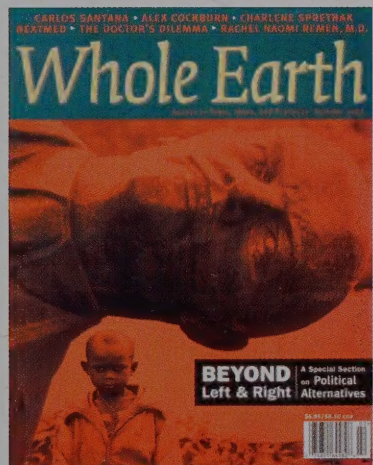
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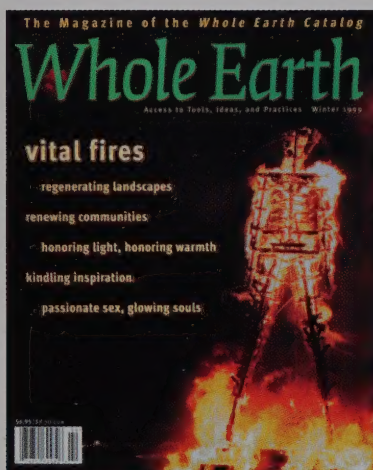
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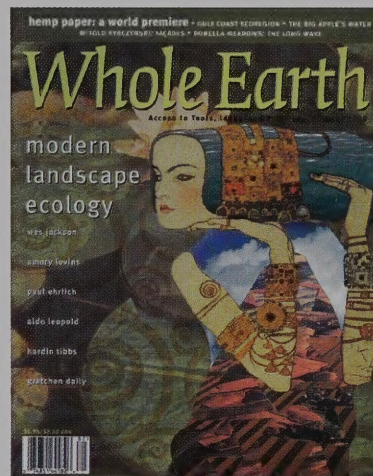
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